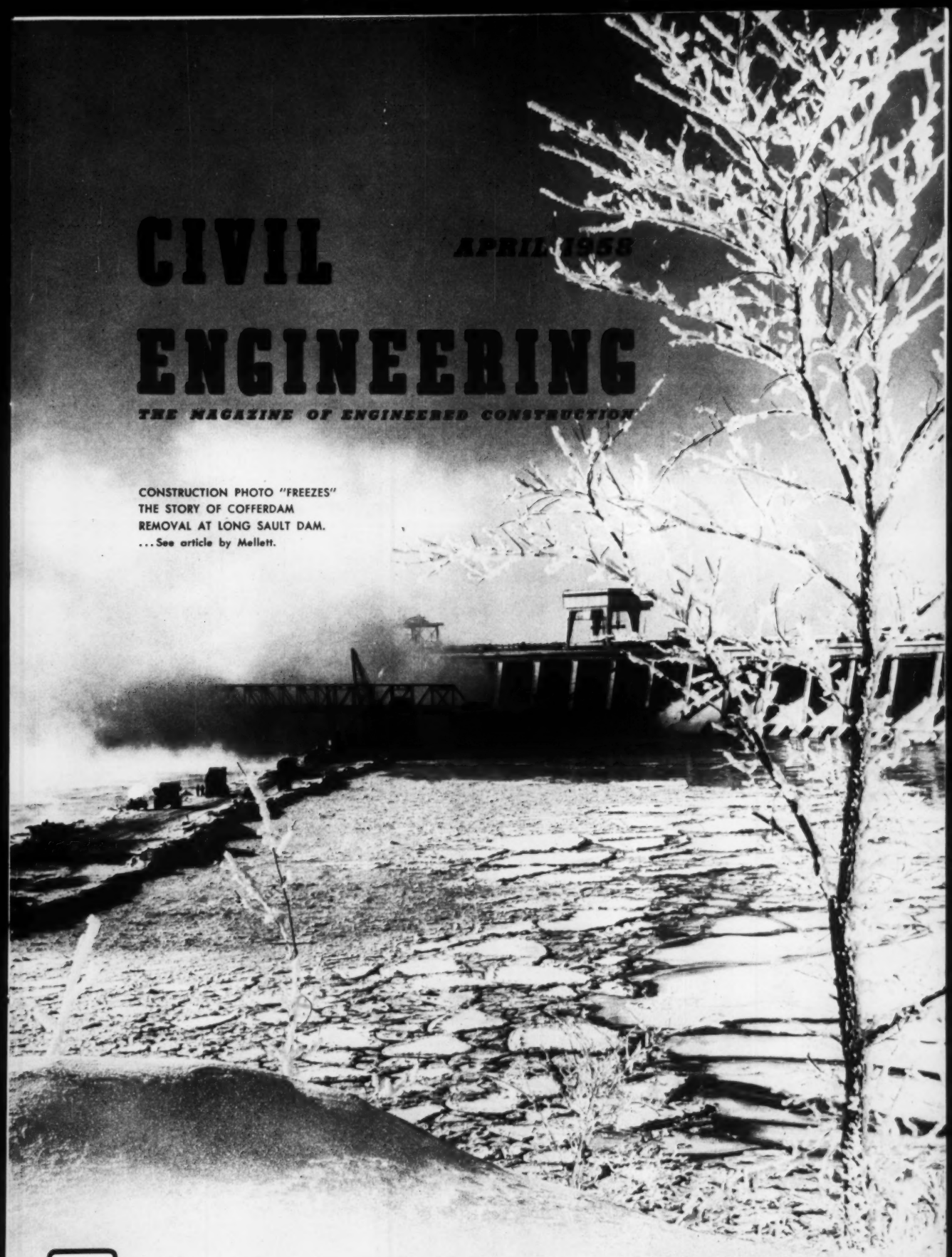
CIVIL ENGINEERING

APRIL 1958

THE MAGAZINE OF ENGINEERED CONSTRUCTION

CONSTRUCTION PHOTO "FREEZES" THE STORY OF COFFERDAM REMOVAL AT LONG SAULT DAM. ...See article by Mellett.



AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

MAKE PLANS TO ATTEND POST-CONVENTION MEETING IN HAWAII — JULY 1, 2

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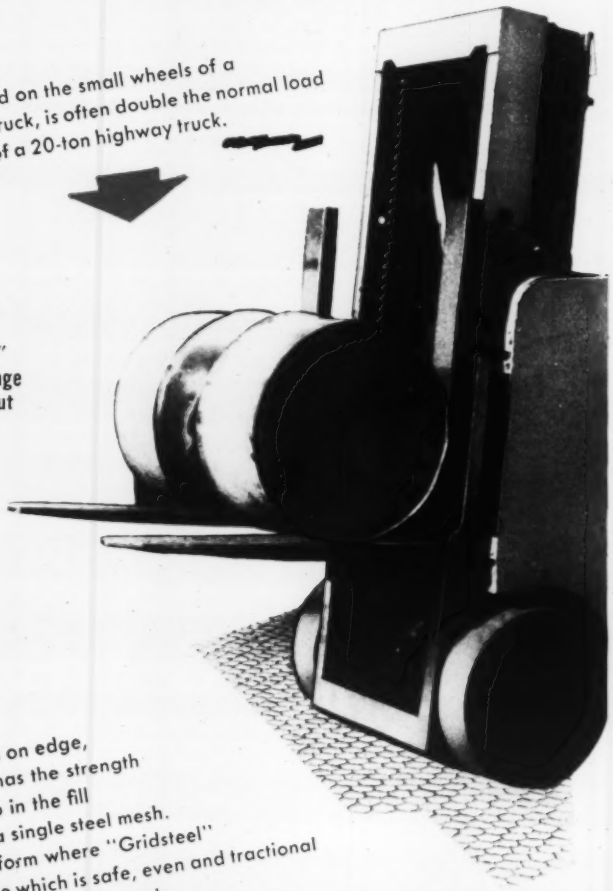
IRVING
Founder of the Grating Industry

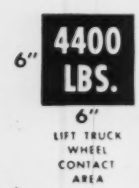
asks: CAN YOUR FLOOR TAKE TODAY'S HEAVY TRAFFIC ?

The concentrated load on the small wheels of a modern fork lift truck, is often double the normal load applied by the wheels of a 20-ton highway truck.



FOR EXAMPLE:

A 20-ton highway truck (with a wheel load of 16,000 lbs. on a 14" x 20" contact area) has an average load concentration of about 57 lbs. per square inch.



A 4,000 lb. capacity lift-truck (weighing 6,400 lbs. itself) concentrates tremendous loads on its small steel wheels. With a maximum wheel contact of 6" x 6", the load concentration is about 122 lbs. per sq. inch—more than double the load applied by the wheels of a 20-ton highway truck.

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For complete information write for 20-page color catalog on Irving "Gridsteel".

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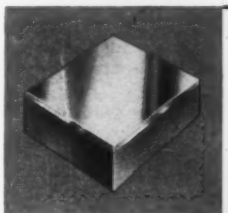
✻ **For information you can use,** *write to Manager, Marketing Service, 161 Lukens Building, Lukens Steel Company, Coatesville, Pennsylvania. Be sure to ask for special bulletin 180.*



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APRIL 1958

VOL. 28 • NO. 4

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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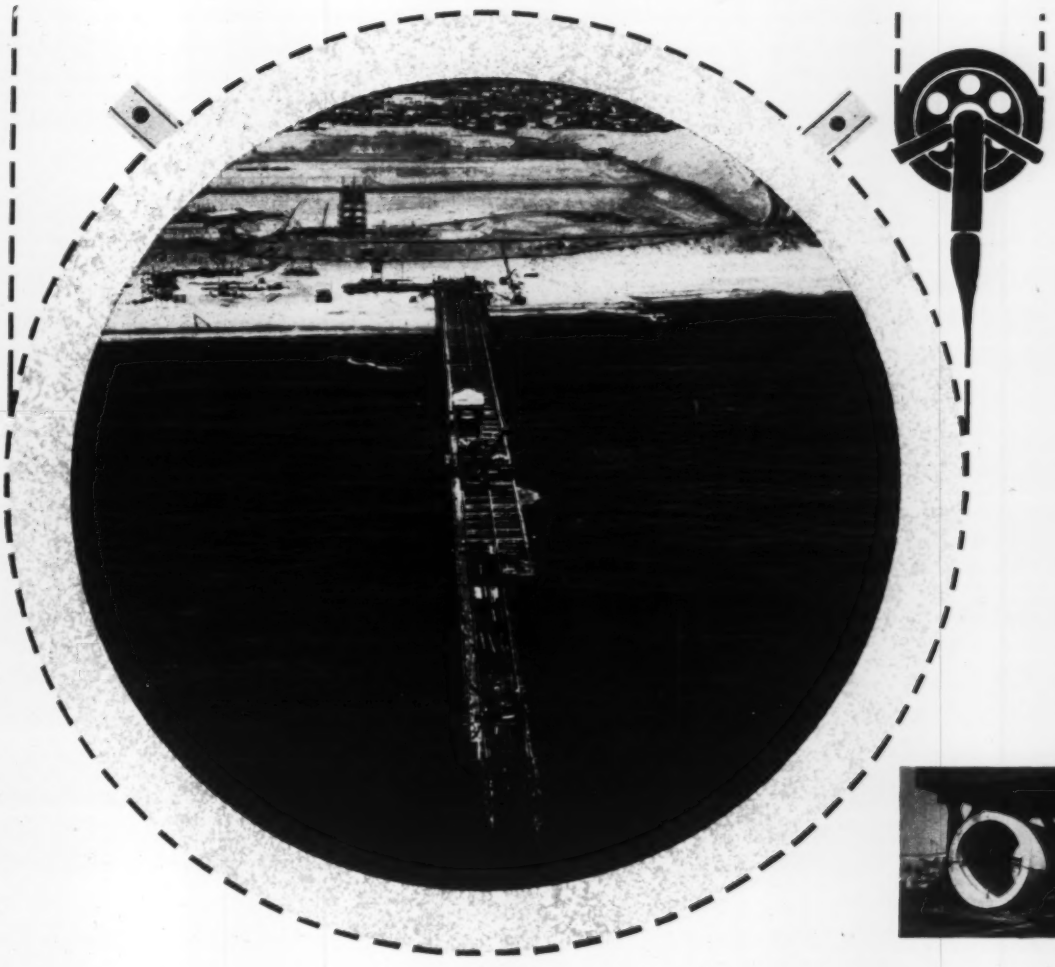

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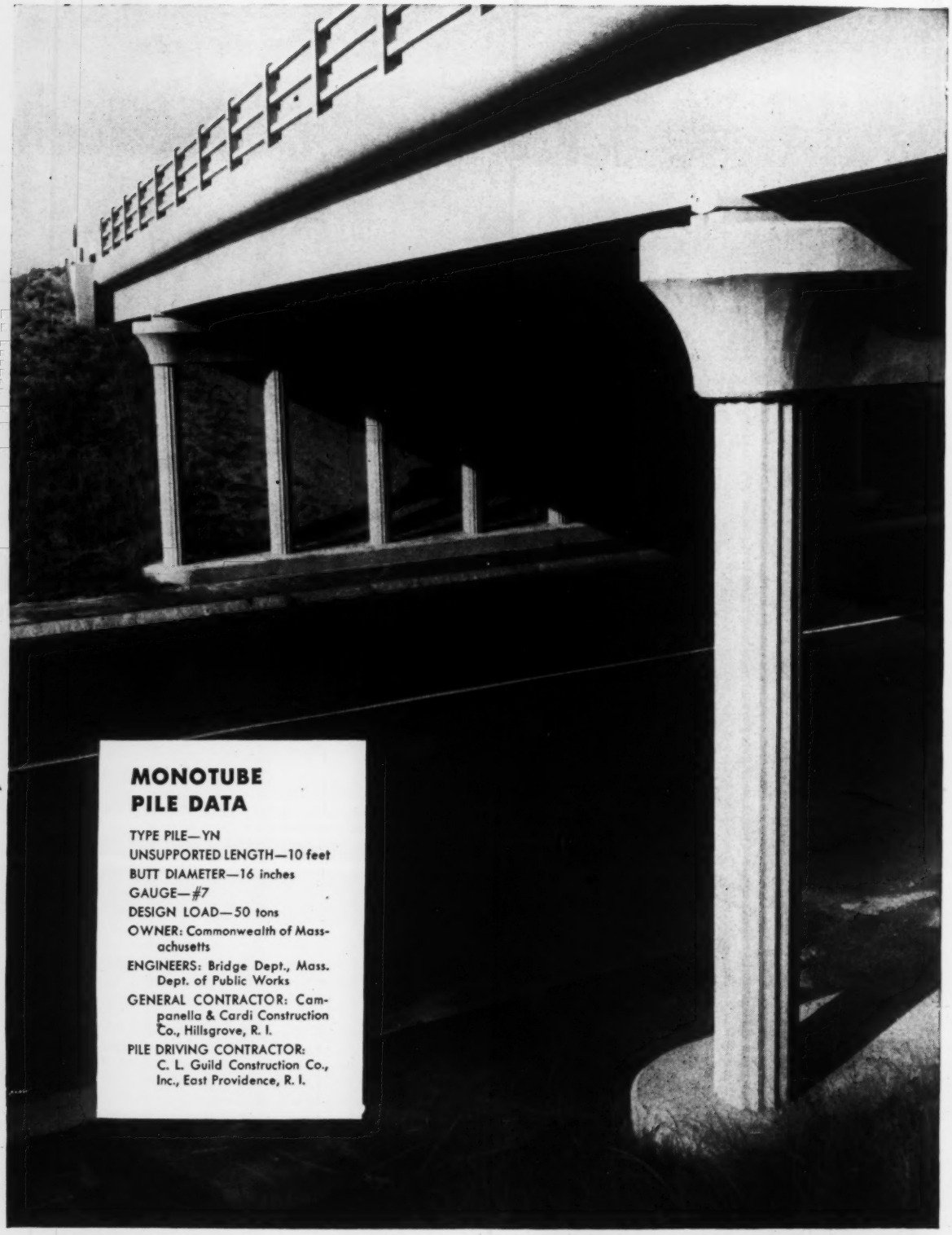

MONOTUBE PILE DATA

TYPE PILE—YN
UNSUPPORTED LENGTH—10 feet
BUTT DIAMETER—16 inches
GAUGE—#7
DESIGN LOAD—50 tons
OWNER: Commonwealth of Massachusetts
ENGINEERS: Bridge Dept., Mass. Dept. of Public Works
GENERAL CONTRACTOR: Campanella & Cardi Construction Co., Hillsgrove, R. I.
PILE DRIVING CONTRACTOR: C. L. Guild Construction Co., Inc., East Providence, R. I.

STRENGTH *plus* VERSATILITY with Monotube piles . . . a perfect combination for this bridge on the Mid-Cape Highway, Dennis, Mass. *Acting as columns*, as well as foundations, Monotube steel piles provide necessary strength, eliminate column form-work and add to architectural beauty.

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Monotube Foundation Piles

Making earthmoving PROFIT history from New England to New Zealand

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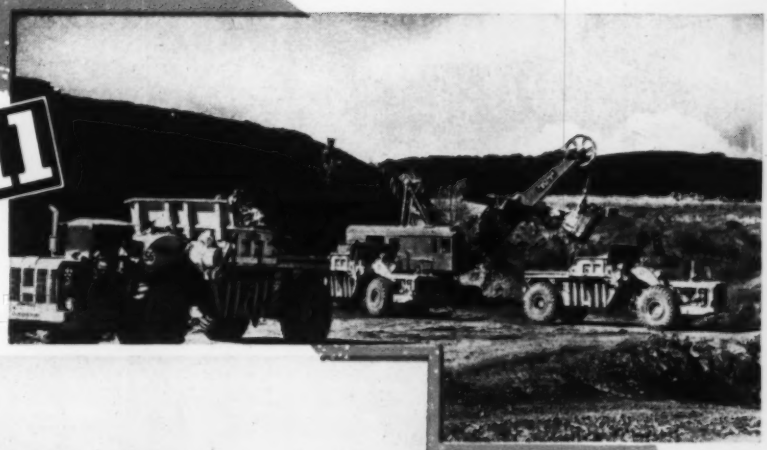
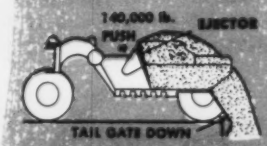


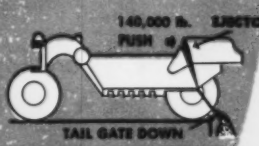
Three of a fleet of ten Yuba Movalls stripping coal overburden at Huntley, New Zealand. These 32-ton capacity units are powered by AC T-360 prime movers.

Two 32-ton Yuba Movalls replaced five conventional heavy-duty end dumps on a 5 mile section of Massachusetts Turnpike involving movement of 2,725,000 yards of rock and earth. These are powered by Cat DW-21s.

LOADED — The big target, big capacity body carries its load low, maintaining high ground clearance since frame and body are integral and compact.



DUMPING — Level body offers no gravity resistance, with potential 140,000 lb. ejector push assuring complete positive discharge with minimum use of power.



EMPTY — Sides and bottom are scraped clean, eliminating need for "mucking out" or decreasing capacity for next full load. Complete ejection takes only 11 to 14 seconds.

MA-802

The rugged multi-purpose high speed hauler that outperforms rear-dumps and bottom-dumps on more types of off-highway jobs

These typical jobs illustrate Yuba Movall versatility. Exclusive level action positive ejector discharges heaviest rock, frozen muck, or any top loaded material, or spreads on the fly. High clearance, short turning radius, full stability during all operations, big tire flotation and traction, big capacity—these add up to more yards, less downtime, bigger year 'round profits. For full information, see your Allis-Chalmers, Caterpillar, or International Harvester Dealer—or phone or write Yuba direct.

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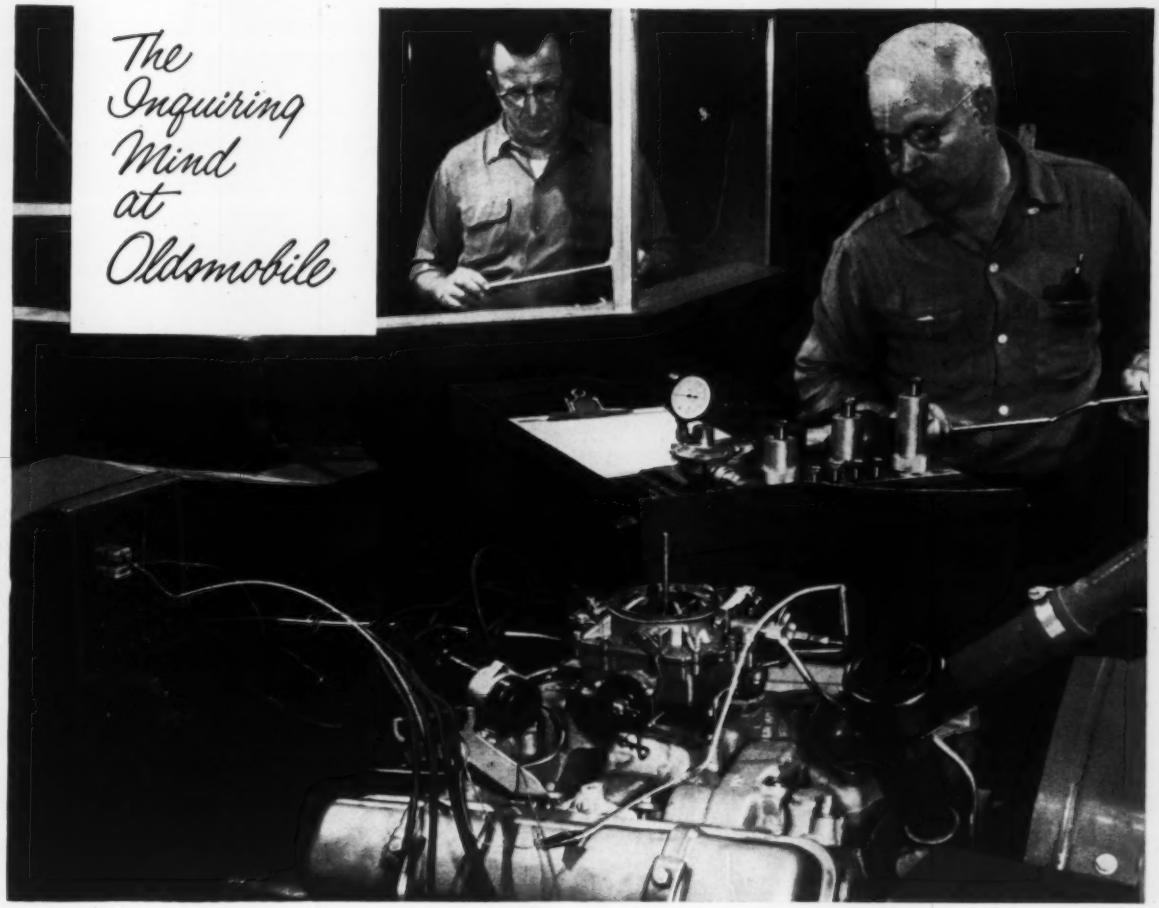
The Inquiring Mind at Oldsmobile



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To Olds engineers, compression ratio is a direct measure of the engine's thermodynamic efficiency; the higher the compression ratio, the more energy utilized from the fuel. But with higher compression ratios, engineers needed to know whether cylinder heads and combustion chambers were accurate during initial engine development. To meet this challenge, Oldsmobile engineers and General Motors Research developed a simple, yet extremely accurate measuring device commonly called the "whistle checker".

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In many ways and in many directions the Inquiring Mind at Oldsmobile is constantly probing, constantly seeking new and better ways to build the finest automobiles in the industry. Try a '58 Oldsmobile on the road. You'll discover the difference for yourself.

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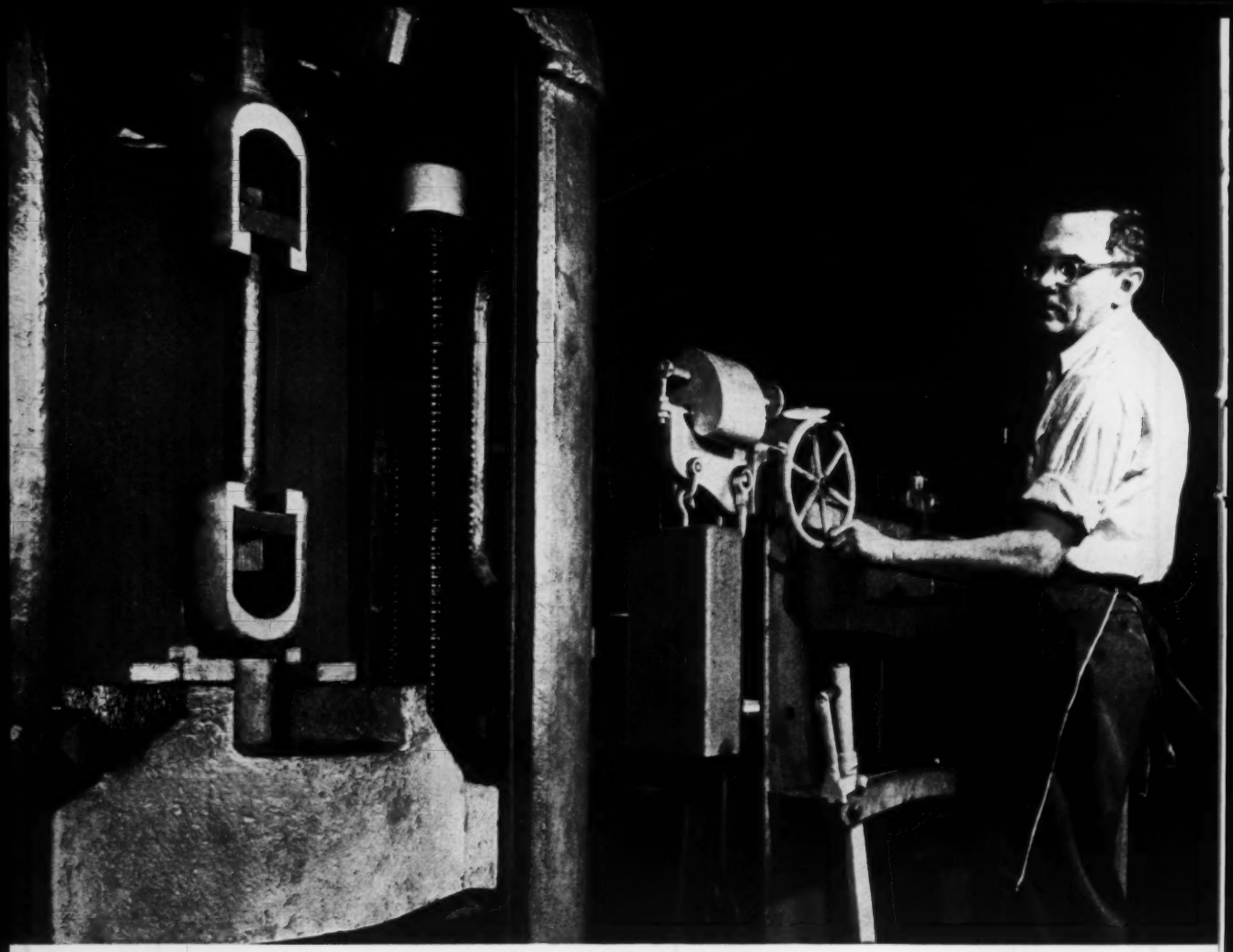

In this tensile testing machine, Bethlehem High-Strength Structural Bolts are tested full size in commonly used diameters. We can test bolts as large as 2½ in. diameter, such as the one shown.

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All heat-treatment lots of Bethlehem High-Strength Bolts are tested in accordance with the requirements of ASTM Spec. A-325-55T, which covers all sizes of bolts for numerous applications. Because of the full-size testing, used in preference to standard test bars or turned specimens, any non-uniformities in the bolts, either in structure or tensile properties, can be fully evaluated.

If you would like to have more information about the manufacture, testing, or installation of high-strength structural bolts, simply write the Bethlehem sales office nearest you.

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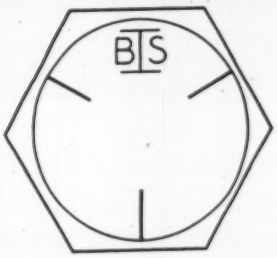
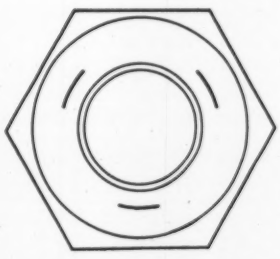
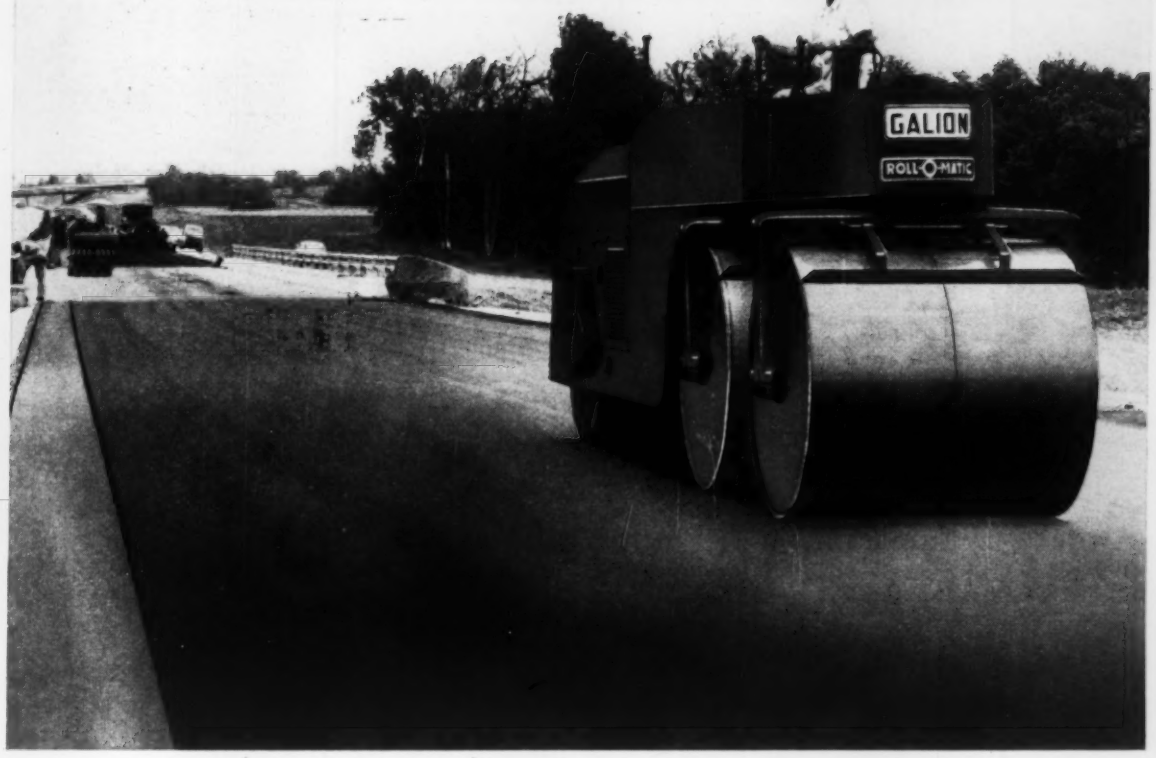


Bethlehem High-Strength Bolts are identified by trademark, plus three raised radial lines, on bolt head.



Typical American Standard Heavy Semifinished Nut used with high-strength bolt. It meets ASTM Specification A-325, and is identified by three depressed arcs in the crown.

for Maximum PRODUCTION



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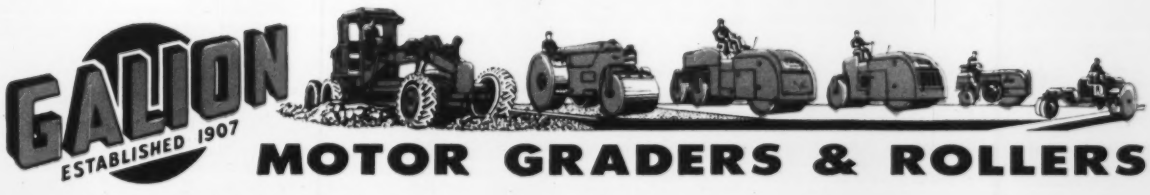

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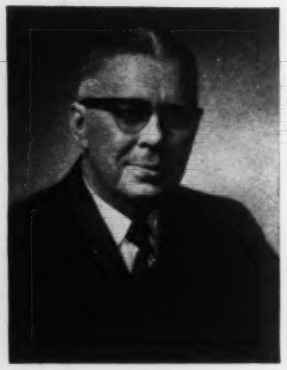

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Chief Engineer
Water Supply Board
Providence, R.I.

"Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can lay Transite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

Transite Pressure Pipe helps you cut system costs 3 ways: in design . . . installation . . . operation!

Today, in every part of the nation, municipal and consulting engineers choose Transite® Pressure Pipe. Ask why, and you find that economy is always among the Transite advantages they consider most important. For no pipe does so much to help keep your costs low in three different areas:

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savings have helped us absorb in labor and material costs..."

Crews of Fanning and Doorley Construction Co. installing 8" line in Providence, R. I.

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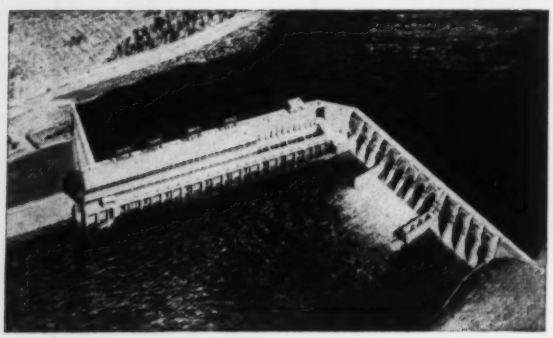
5,600 tons of USS Steel Sheet Piling

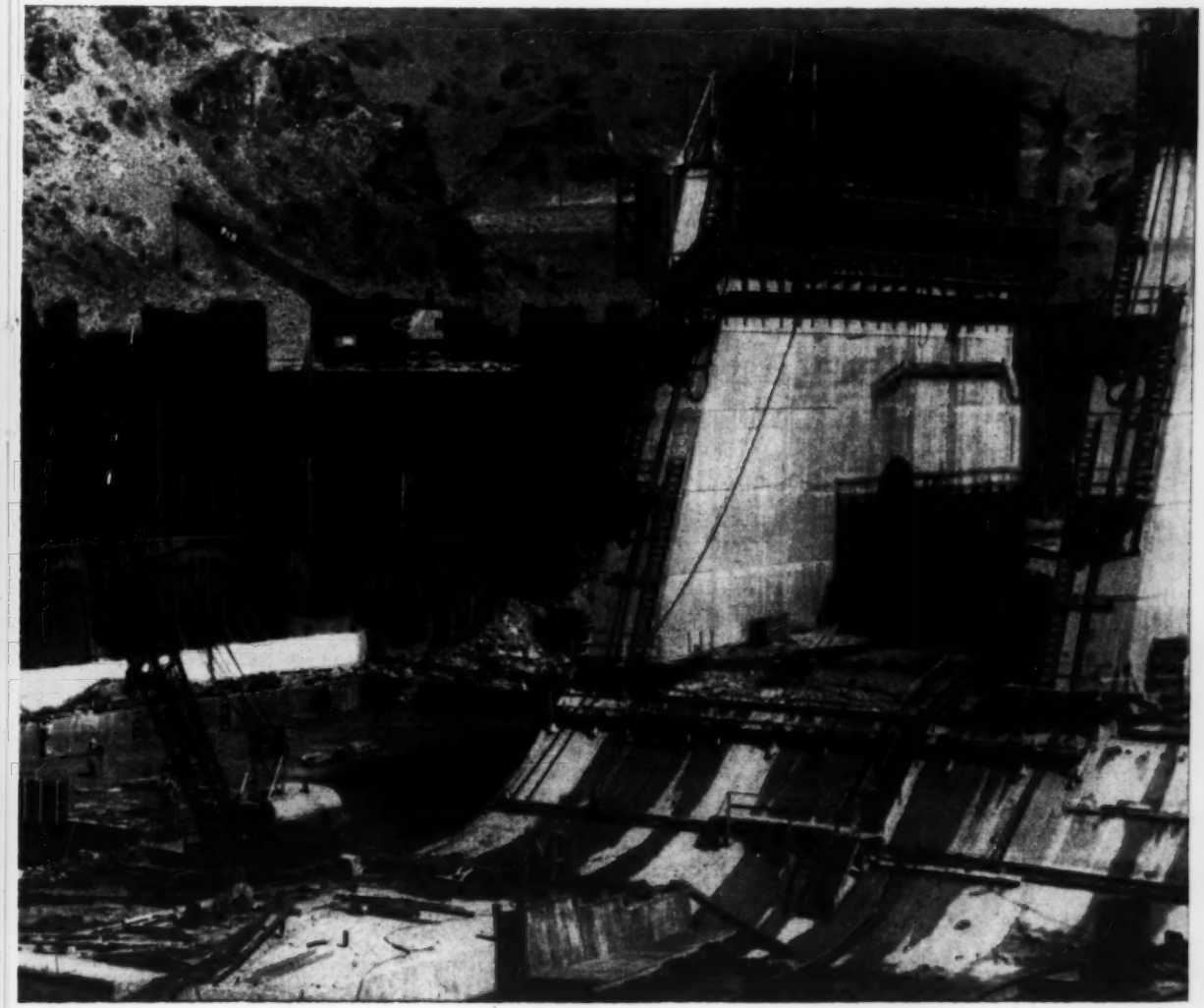


Rocky Reach Hydroelectric Project, Public Utility District No. 1, Chelan County, Wenatchee, Washington. Ultimate capacity: 1,200,000 kilowatts; Length of dam: approximately 5,000 feet, including 2,000 feet water-impervious earth cut-off; Height of spilling from bedrock: 127 feet; Normal pool area: 9,000 acres.

Designers and Engineers: Stone & Webster Engineering Corporation

General Contractors: Rocky Reach Dam Builders (a joint venture of four widely known firms). Pile Driving Sub-Contractor: Lebouef and Dougherty Construction Co., Richmond, California

USS MZ Piling of the type used for permanent cut-off walls to obtain high beam strength.



delivered on time for quick erection at Rocky Reach Dam, Washington

The new $273,100,000 Rocky Reach Hydroelectric Project near Wenatchee, Washington, needed steel sheet piling to start the project before the beginning of the annual flood stage of the Columbia River. Five thousand six hundred tons of steel sheet piling was made in Pittsburgh and delivered on time.

The USS Steel Sheet Piling was used to construct a portion of the 24-cell cofferdam, upstream and downstream cut-off walls and east abutment dam. The cofferdam was built in 103 days, or one cell every 4 working days. For this, USS MP-101 straight-web piling, driven to solid rock for maximum strength in tension, was used. Lebouef and Dougherty Construction Co., pile driving sub-contractor, states that the sheet pile interlock sizing was excellent and the piling placed without difficulty.

The cut-off walls were built with USS MZ Piling for maximum beam strength. These were also driven to solid rock for a permanent installation.

This is another case that illustrates the excellent cooperation on deliveries made possible by U. S. Steel's large production facilities and attention to customers' needs. When you want any type of piling—steel sheet or H-beam bearing piling—get in touch with the United States Steel office near you.

USS is a registered trademark

USS

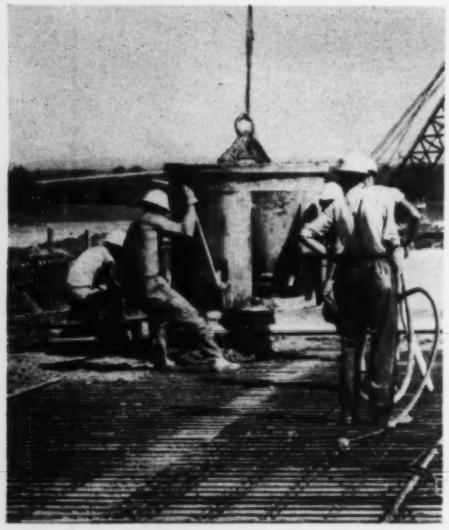
United States Steel Corporation, Pittsburgh
Columbia-Geneva Steel, San Francisco
Tennessee Coal & Iron, Fairfield, Ala.
United States Steel Export Company

United States Steel

Plastiment Concrete Densifier

Cuts Construction Time

ON HARTFORD'S WINDSOR BRIDGE



▲ DECK CONCRETE IS PLACED AND VIBRATED INTO A MONOLITHIC MASS WITH BEAMS.

14 PAIRS OF 120 FOOT SPANS WERE CONCRETED IN 99 DAYS. ▼

Rapid construction of concrete spans on this 1677 foot bridge across the Connecticut River came as no surprise to the contractor and consulting engineers. . . . Using this new procedure, these monolithic cast-in-place prestressed concrete spans were completed in a record 99 days. . . . This new monolithic beam and slab construction procedure was made possible by controlling the set of concrete with Plastiment Concrete Densifier.

The contractor increased the Plastiment proportion for the 7 foot deep beams which were placed in the morning. . . . After lunch this concrete was further consolidated by revibration. . . . Then the deck slab concrete containing a normal Plastiment proportion was placed and carefully vibrated into a monolithic mass with the beams. . . . Although initial set was retarded, strength developed very rapidly to 3000 psi within four days. . . . Prestressing operations were begun, forms removed, and in less than 10 days 20-ton truck mixers were moving across the span to place other spans.

The Plastiment characteristics of set control and rapid development of high strength make possible considerable savings in construction time. . . . It also provides an additional bonus of structural benefits including reduced cracking, increased density and higher bond to steel. . . . Let Plastiment save time and dollars for you. . . . For complete information write for Bulletin PCD.

Greater Hartford Bridge Authority—Owner
The Preload Company, Inc., N. Y. C.—Consulting Engineers for Prestressed Design and Construction
Merritt-Chapman & Scott, N. Y. C.—Contractor
DeLeuw Cather & Brill, N. Y. C.—Consulting Engineers for Owner
Thomas Worcester, Boston Mass.—Design Consultants

Ad 26-10

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PASSAIC, NEW JERSEY
DISTRICT OFFICES: ATLANTA • BOSTON • CHICAGO • DALLAS • PHILADELPHIA • PITTSBURGH • NEW ORLEANS • SALT LAKE CITY • WASHINGTON • DEALERS IN PRINCIPAL CITIES — AFFILIATES AROUND THE WORLD
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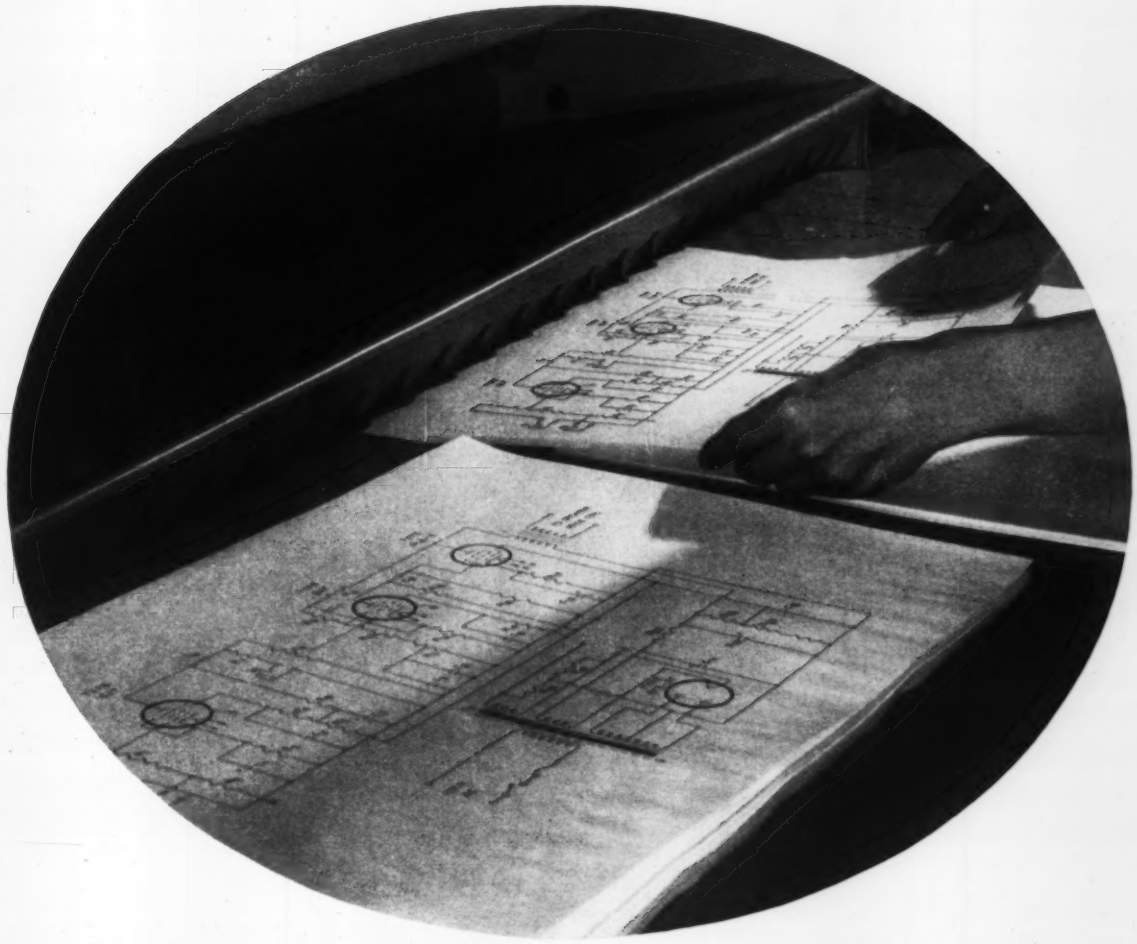

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Same "second original" makes hundreds of exact copies

The CRONAFLEX "second original" in the picture has already reproduced over a hundred clear, black-line copies. It's good for hundreds more. CRONAFLEX shrugs off kinks and wrinkles, no matter how many times it's passed through a reproduction machine.

The CRONAFLEX matte surface provides the finest pencil and ink acceptance. Lines never smudge. They can be drawn—or erased and redrawn—on either side of the film. You make your corrections right on the CRONAFLEX; your valuable original drawing remains untouched.

CRONAFLEX Engineering Reproduction Films are available in three types: (1) Direct Positive Film, (2) Contact Film and (3) Projection Film. For more information on this revolutionary new line, write: E. I. du Pont de Nemours & Co. (Inc.), Photo Products Department, Wilmington 98, Delaware. In Canada: Du Pont Company of Canada (1956) Limited, Toronto.

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Better Things for Better Living . . . *through Chemistry*

easy

Tyton Joint® assembles so easily even untrained crews become expert in minutes. Only one accessory needed – a specially designed rubber gasket that fits into the bell of the receiving pipe. As the entering pipe slides in, it compresses the gasket to give a permanent, tight seal. No

U.S. cast iron **PIPE**

FOR WATER, SEWERAGE AND

does it!

bell holes. No caulking equipment. No nuts or bolts to fasten. And no weather problems. Tyton Joint pipe can be laid in rain or wet trench if need be. Like to know more about the pipe joint that saves time, money and headaches from one end of the line to the other? Call or write today.

U. S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

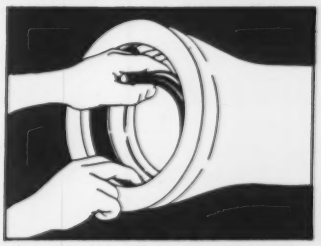
A WHOLLY INTEGRATED PRODUCER FROM MINES
AND BLAST FURNACES TO FINISHED PIPE

"SHECKS, WE DIDN'T NEED YORE MUSCLES,
AUNT BEANY... A LI'L PUSH FROM
ANY ONE OF US PUTS IT TOGETHER."

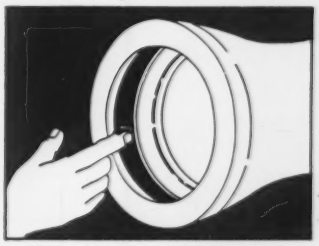
INDUSTRIAL SERVICE CAST IRON

TYTON

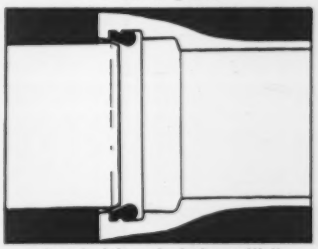
ONLY FOUR SIMPLE ACTIONS



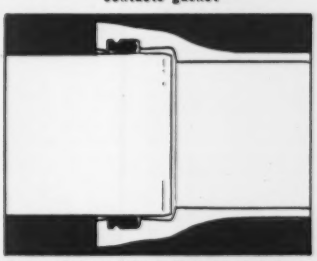
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket... the job's done!

8" Tyton Joint pipe for water main addition in Colorado.

DELAWARE HIGHWAY DEPARTMENT SELECTS PRESTRESSED CONCRETE FOR NEW BRIDGE...

(*Above*) Placing the last of the first five spans of the new Fenwick Island Bridge. There will be eleven spans in all with a total length of 440′. Box beams are 39′ 11″ x 3′ wide and weigh about 10 tons. Each span requires 13 beams.

Owner: Delaware State Highway Department

Designed by: Bridge Division, Delaware State Highway Department

Contractor: George & Lynch, Inc., Wilmington, Del.

Prestressed Beams Manufactured by: Eastern Prestressed Concrete Corporation, Line Lexington, Pa.

(*At right*) Moving beam from casting bed in background to stockpile, early in the morning at manufacturer's plant. Beam was cast the previous day.

This new bridge links Fenwick Island with the mainland in the famous Delaware-Maryland Seacoast area. Its spans are prestressed concrete, chosen by the Delaware Highway Department for quicker, more convenient construction, at lower costs.

Precast to exacting specifications at the manufacturer's plant, the box beams were trucked to the job site as needed. Beams were quickly lifted from the truck and swung into place by crane—making it easy to place a span of thirteen beams a day.

In manufacturing these beams, Eastern Prestressed Concrete Corporation used Lehigh Early Strength Cement to gain maximum production efficiency. With the concrete reaching 4000 PSI in 18 hours, it was possible to make 8 beams every other day using only one 345′ casting bed.

This is typical of the advantages of Lehigh Early Strength Cement in modern concrete construction.

LEHIGH PORTLAND CEMENT COMPANY Allentown, Pa.

Contractor:
BRIDGES ASPHALT PAVING COMPANY
St. Louis, Missouri

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LACLEDE'S WELDED WIRE FABRIC adds vital strength and permanence to street and highway repairs and overlays.

By maintaining the asphalt over-coating in place . . . the heavily traveled lanes of one of St. Louis' busiest streets have been reinforced against creep and surface deterioration. Even at bus stops the movement and gouging of the pavement is minimized.

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- CENTER JOINTS
- RECESS JOINTS
- TIE BARS
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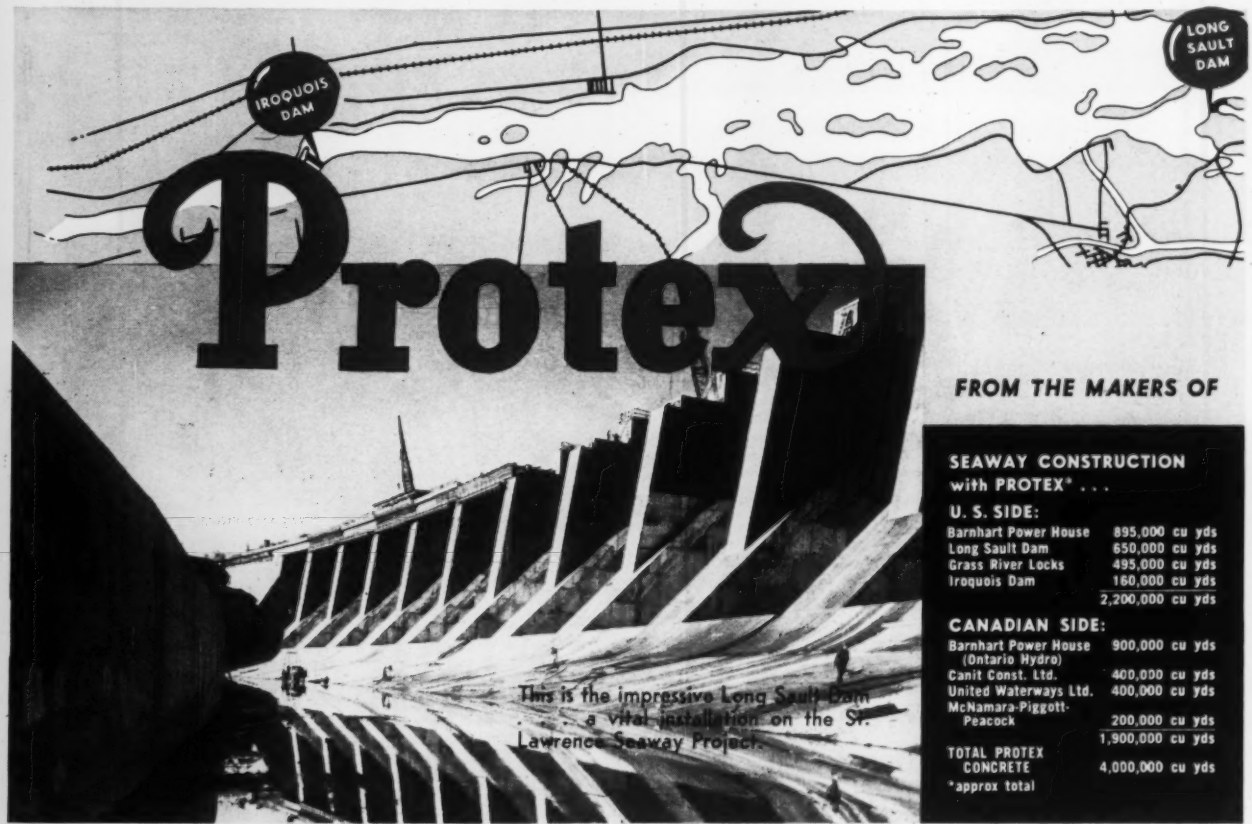
SAINT LOUIS, MISSOURI ◆ Producers of Steel for Industry and Construction

still the International choice


IROQUOIS DAM
LONG SAULT DAM
Protex
This is the impressive Long Sault Dam ... a vital installation on the St. Lawrence Seaway Project.

FROM THE MAKERS OF

SEAWAY CONSTRUCTION with PROTEX* . . .

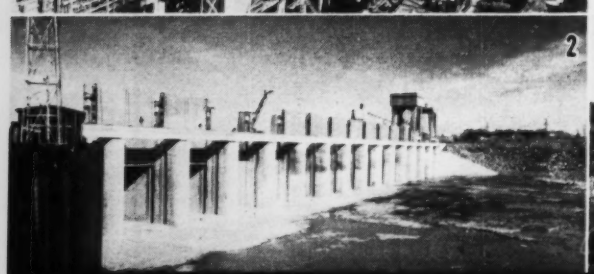
U. S. SIDE:	
Barnhart Power House	895,000 cu yds
Long Sault Dam	650,000 cu yds
Grass River Locks	495,000 cu yds
Iroquois Dam	160,000 cu yds
	2,200,000 cu yds
CANADIAN SIDE:	
Barnhart Power House (Ontario Hydro)	900,000 cu yds
Canit Const. Ltd.	400,000 cu yds
United Waterways Ltd.	400,000 cu yds
McNamara-Piggott-Peacock	200,000 cu yds
	1,900,000 cu yds
TOTAL PROTEX CONCRETE	4,000,000 cu yds

*approx total

1 Massive Barnhart Power Dam. Overall view of power dam construction. This international project being built by the United States and Canada proved the economy of PROTEX.

2 Iroquois Dam. One of the first large structures nearing completion on the St. Lawrence Seaway Project. On this and comparable projects world wide, contractors continue to prove the best actually costs less with PROTEX.

3 Grass River Locks. St. Lawrence Seaway Project, Massena, New York. When completed these locks will raise vessels 85 to 90 ft. Projects as this prove the low cost per cubic yard of air entrainment with PROTEX.



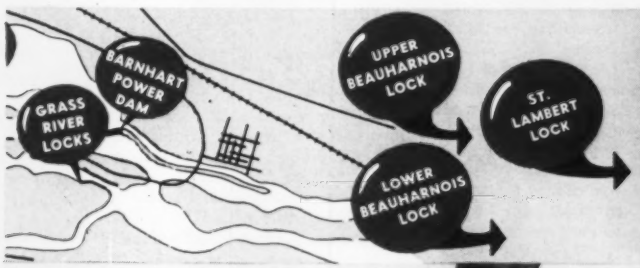
AUTOLENE LUBRICANTS COMPANY

Industrial and Research Division

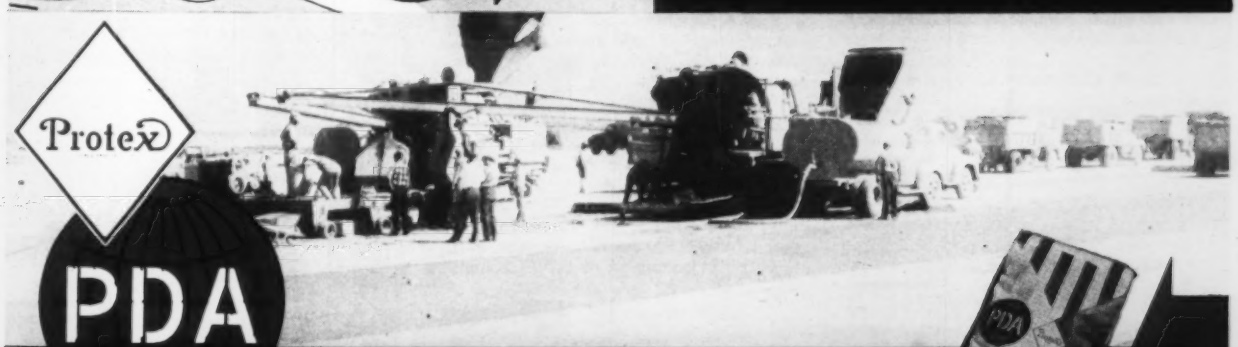
1331 WEST EVANS AVENUE DENVER 9, COLORADO

What better example of international cooperation than the new, majestic St. Lawrence Seaway . . . now under construction along the peaceful borders of Canada and the United States? What better example of international acceptance than the specified usage of Protex . . . the world's greatest name in air entraining solutions . . . in the massive volumes of concrete now being poured on both sides of the Seaway project? Whether your next concrete job is small or large . . . here or half a world away, you should know about and use Protex . . . still the International choice!

Yes, no matter where you are . . . Canada, the United States, France, Brazil, Alaska, Colombia, Japan or the West Indies . . . you'll find Protex ON THE JOB!



ST. LAWRENCE SEAWAY PROJECTS that are now using PROTEX AIR ENTRAINING SOLUTION for better, more economical concrete placement



Protex

PDA

FIELD PROVEN ECONOMY

in all phases of Concrete Placement!

PDA . . . packaged in a durable bag . . . comes to you in convenient powder form . . . easily mixed and dispensed . . . complete dispensing installations available upon request.

Shown above is a recent PDA installation at U. S. Naval (Buckley) Airfield, Denver, Colorado

PROTEX Dispersing Agent . . .

PDA increases strength at any age through water reduction and cement dispersion, improving all the desirable characteristics of concrete, giving a "live" concrete with protection against "hot weather" slump loss and segregation—allows the placing of controlled durable air entrained concrete without plastic shrinkage cracks. PDA is a selective initial retarder—retarding only the initial set of concrete for extended vibration and finishing time (not delaying form stripping time) YET it gives no retardation in winter concreting—thus year around benefits are obtained with "all season" PDA.

Proven, Dependable, Adaptable

PROVEN in the field . . . PDA insures the successful and economical placement of better quality concrete!

DEPENDABLE — YES! Proof positive from Government and private projects. Also backed by the world-known and world-respected PROTEX name!

ADAPTABLE to any need . . . PDA improves any Pre-stressed, Slip-form, Lightweight, Tunnel-lining, Tilt-up or Lift-slab concrete project!

PDA's basic material is purified and desugared having been field tested and proven over past years giving you all the well known benefits—greatest water reduction — cement dispersion — maximum workability and durability — plus PROTEX economy and reliability.

FOR BETTER AND MORE ECONOMICAL PLACEMENT OF CONCRETE, SPECIFY AND USE PDA . . . FROM THE MAKERS OF PROTEX!

☐ Please send new, revised free booklet, "Facts on Modern Placement of Concrete Through Air Entrainment"!

☐ Please send new, informative free booklet, "PDA—Protex Dispersing Agent"!

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NEWS OF ENGINEERS

The American Institute of Consulting Engineers has chosen its executive council for the coming year. **Herschel H. Allen,** the new president, is senior partner in the J. E. Greiner Company, of Baltimore and a past-president of the Maryland Section. The governing council will consist of **Theodore T. McCrosky,** consulting engineer of New York City; **George S. Richardson,** principal partner in Richardson, Gordon & Associates, Pittsburgh; and **Richard H. Tatlow III,** president of the Abbott, Merkt & Company of New York City. New vice-presidents of the Institute are **Ellis E. Paul,** partner in Howard, Needles, Tammen & Bergendoff, of New York, and Mr. Tatlow.

Charles C. Estes, chief engineer of the Forest Preserve District of Cook County, Ill., has been appointed a member of the new Northeastern Illinois Metropolitan Area Planning Commission. This Commission will study Cook and a number of adjacent counties with emphasis on water, sewers, and transportation. Mr. Estes has been with the Forest Preserve District since 1929.

William E. Schaem, supervising structural engineer in the Office of the Chief of Engineers, received a special $3,700 civilian award from Major Gen. Walter K. Wilson, Deputy Chief of Engineers for Construction. The award recognizes the approximately $6 million savings effected by Mr. Schaem's proposal for reinforcing rigid concrete girders with high strength steel bands. With a $1,300 earlier award, Mr. Schaem has received the maximum monetary award which the Army can give a civilian employee.

W. E. Schaem

William Whipple, Brigadier General, Corps of Engineers, will take over the responsibilities of division engineer for the Corps of Engineers' Southwestern Division at Dallas, Tex. General Whipple, a former Rhodes Scholar, was, until recently, in command of the Communications Zone Base Section in Poitiers, France.

Alfred R. Golzé has been named Assistant Commissioner of Reclamation in the Department of the Interior, Washington, D. C. In his new position, Mr. Golzé, who has been with the Bureau of Reclamation for 23 years, will be responsible for general administrative detail, including contract administration. Prior to his new appointment, Mr. Golzé was chief of the Division of Program Coordination and Finance.

William A. Conwell has been elected vice-president of the Engineering and Construction Division of the Duquesne Light Company, Pittsburgh, Pa. Mr. Conwell has been with Duquesne Light since 1937, and previously served as structural engineer in the Design Department. He supervised structural engineering for the Shippingport Atomic Power Station and the Elrama Power Station and for the flood protection of the Colfax and Reed Power Stations.

W. A. Conwell

William Foster, F. H. Zurmuhlen, and **Edward J. Cleary** have been named to the Board of Trustees of the American Public Works Association's Research Foundation. For Mr. Foster, this will be a first term as trustee while Messrs Cleary and Zurmuhlen were re-elected.

J. Stephen Watkins, G. Reynolds Watkins and **Melbourne Mills** announce the formation of a new firm, Watkins and Mills. The firm will have its offices in Lexington, Ky., and will practice architecture and engineering.

Paul L. Nichols has opened offices in California and Hawaii for the practice of professional engineering. The firm, Paul L. Nichols and Associates, will offer designs, plans and supervision for civil engineering projects, and will specialize in water supply and waste water disposal, highways and related structures.

Alfred L. Parme has taken over the managership of the Structural and Railways Bureau of the Portland Cement Association. Mr. Parme has been assistant to the Structural Bureau Manager for four years. **Walter E. Kunze, Jr.,** will step into the job of assistant manager. Mr. Kunze has been with the firm for five years, previously as a structural engineer.

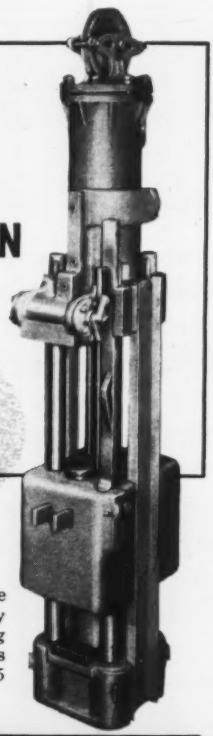
New Modern Design —Sound Engineering

produced this outstanding

WARRINGTON—VULCAN

Single-Acting

STEAM PILE HAMMER



- Heavy ribs give more support to cylinder head . . .
- Shorter channels permit easier insertion of hammer into leaders . . .

Operating at a medium steam pressure this versatile hammer delivers a moderate frequency of low velocity blows from a relatively heavy ram. A favorite for driving piles of all descriptions. Made in 6 sizes with Rated Striking Energy from 825 ft. lbs. to 30,225 ft. lbs.

Ask for full information

VULCAN IRON WORKS INC. 327 North Bell Avenue, Chicago 12, Illinois

Manufacturers of Pile Driving Hammers Since 1852

The H. K. Ferguson Company announces that **James R. Fraser** will take over the responsibilities of vice-president of engineering in the Cleveland office. Mr. Fraser, who has been with the company for sixteen years, formerly served as the chief engineer and district engineer for the company's Central District.

A. L. Collin has been named chief development engineer in the Montebello fabricating division plant of Kaiser Steel Corporation. Mr. Collin has been with the company since 1955. Prior to his appointment, he was manager of engineering in the Montebello plant where he took part in the development of ground support and service equipment for the missiles and aviation field.

E. J. Quirin recently received the "Annual Award for Distinguished Service to the Community and the Engineering Profession" from the Queens County Chapter of the New York State Society of Professional Engineers. Mr. Quirin is president and director of Frederick R. Harris, Inc., consulting engineers, of New York City.

Ivan C. Crawford has accepted a Presidential appointment as a member of the Board of Visitors to the U.S. Military Academy for a two-year term. The Board checks educational standards and needs of the Academy. Mr. Crawford is the retired dean of the engineering college at the University of Michigan and a former Director of ASCE.

Ivan C. Crawford

Cabell Gwathmey has become a principal in the firm of Masten & Hurd, architects in San Francisco, Calif. He recently retired as director of Department of Licenses and Inspections of the District of Columbia, with headquarters in Washington, D. C.

James A. Anderson has retired from the Virginia State Highway Commission after serving as the Highway Commissioner for 16 years. Under Mr. Anderson's supervision, the Highway Department has expanded considerably. Governor Stanley spoke at recent retirement ceremonies, held to honor Mr. Anderson on his accomplishments.

N. D. Brodkin has been named chief engineer of the New York City Transit Authority. He has served the Authority since 1924 as designer, designing engineer in charge of route planning, and assistant general superintendent with the Operating Division.

The Department of the Interior has honored **Joseph S. Gatewood** for 34 years of outstanding service to the government. Mr. Gatewood was recently given a Distinguished Service Award, which is the highest honor conferred upon the employees by the department. The recognition came for "outstanding scientific contribution in performance of duty." Until his retirement a year ago, Mr. Gatewood held the post of hydraulics engineer.

Grant Bloodgood and **E. G. Nielsen** have been promoted to two top engineering posts with the Denver office of the Bureau of Reclamation. Mr. Bloodgood will serve as the new assistant commissioner and chief engineer, while Mr.

Grant Bloodgood

E. G. Nielsen

Nielsen, former assistant commissioner in Washington, D. C., will succeed Mr. Bloodgood as associate chief engineer. Both men have long records of service with the Bureau. Mr. Bloodgood joined the staff in 1920, and Mr. Nielsen in 1934.

D. F. Peterson, Jr., has taken the position of dean of engineering at Utah State University. He was formerly the head of the Civil Engineering Department at Colorado State University.

Tadius J. Gutt has been named vice-president and general manager of the George Rackle & Sons Company, Cleveland structural concrete manufacturers. Mr. Gutt formerly served as general manager of the Texas Stressed Concrete Corporation, joining the Rackle firm as assistant to the president in 1956. In his work with the company, he has been closely associated with the expansion of its product group.

Tadius J. Gutt

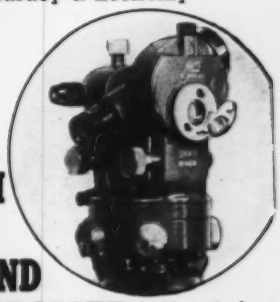
Stephen H. Meem, formerly director of engineering and research for the American Road Builders Association, has taken on the responsibilities of managing director of the engineering division of the Association. He is in the World Center Building in Washington, D. C.

*IN TEXAS ...AND THE WORLD OVER

KERN SURVEYING INSTRUMENTS

*The Bridge Division of the State of Texas Highway Dept. uses Kern Instruments

WORLD FAMOUS FOR
Working Speed
Operational Simplicity
Accuracy & Economy



DKMI TEN SECOND THEODOLITE (with optical micrometer)

- Exceptional portability and precision.
- Readings automatically ... AT A GLANCE.
- Direct reading to 10". Estimation to 1". Average working accuracy —3-4 secs.
- Can be used with electric lighting unit for night work.

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Unique—a Kern first! Centers instruments in seconds with remarkable accuracy. Assures exceptional stability with ball-and-socket head, supporting instrument coupling.

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FACTORY TRAINED PERSONNEL

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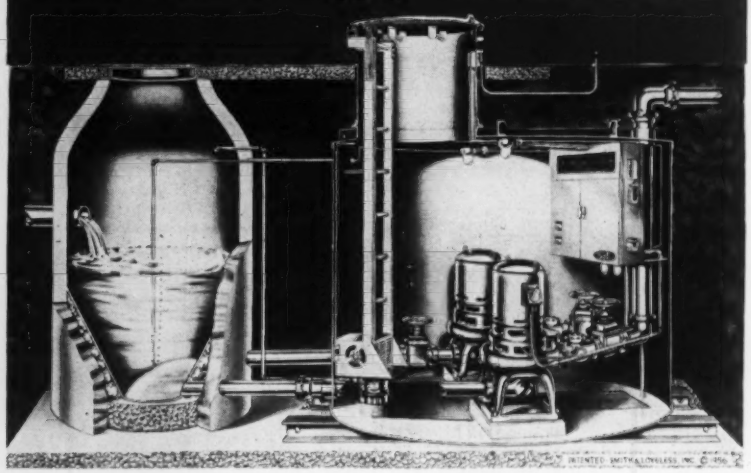
The FINEST in SURVEYING EQUIPMENT

KERN INSTRUMENTS INC.
120 Grand St., White Plains, N. Y.

SEWAGE PUMPING IS NO PROBLEM WITH

Smith & Loveless

FACTORY-BUILT SEWAGE LIFT STATIONS



Ten years of experience in building hundreds of sewage pump stations yearly is your guarantee of sound design and top quality. Smith & Loveless offer a complete line of six standard size lift stations with capacities from 20 G.P.M. to 2000 G.P.M. per pump or ejector. Larger capacity stations are built to your order.

- An integrated design, each piece proven by the test of time
- Precision assembled by factory experts
- Automatic dehumidifier to eliminate condensation
- A central electrical control cabinet prewired and color coded
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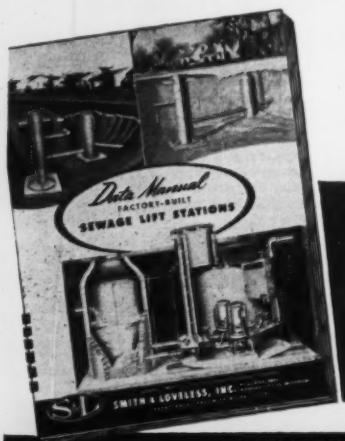
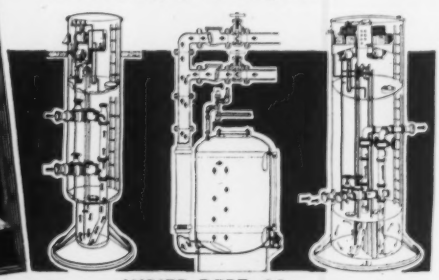
- Factory tested and adjusted by actual operation before shipment
- Easily and quickly installed
- Especially designed for minimum maintenance

GET YOUR FREE COPY OF SMITH & LOVELESS LIFT STATION MANUAL



Contains over 100 pages of design notes, selection charts, dimension drawings, specifications, diagrams, and a list of installations in 40 states.

A card to Dept. 80 will bring your data manual promptly. No obligation.



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MANUFACTURERS OF WATER & SEWAGE TREATMENT EQUIPMENT

S&L Smith & Loveless, Inc.

P.O. BOX 8884 KANSAS CITY, MISSOURI

REPRESENTATIVES IN PRINCIPAL CITIES

A. W. Freed has been named head of the Engineering Branch of the Installations Division at McClellan Air Force Base near Sacramento, Calif. Mr. Freed, who has just completed an assignment in Argentia, Newfoundland, has been with the Navy since 1941.

Sir Claude Inglis has retired as director of the Hydraulics Research Station, DSIR, at Wallingford, Berkshire. Sir Claude has filled this position since 1947, and earlier had a distinguished career with the Indian Service of Engineers. Sir Claude was knighted in 1945 and elected a Fellow of the Royal Society in 1953.

Mihills O. Kelson has been promoted to assistant chief of the Technical Engineering Branch of the Corps of Engineers' North Pacific Division. Mr. Kelson has served with this Division for almost ten years.

William J. Grady has taken the position of manager of construction for Burns & Roe, Inc., a New York City engineering and construction firm. Prior to his new responsibilities, Mr. Grady acted in the capacity of project manager for the Shippingport Power Station. Mr. Grady has been with the firm since 1941.

W. J. Grady

G. B. Schnabel has accepted a promotion to senior market specialist with the Armco Steel Corporation. In this new position, he will be in charge of the steel building promotional program of Armco Drainage & Metal Products, Inc. Mr. Schnabel has been with the firm since 1952.

Carl F. Lind has taken the position of district engineer for the Asphalt Institute in Los Angeles, Calif. He previously was flood control engineer for San Joaquin County. **Richard S. Titera** will be working with Mr. Lind as assistant district engineer. He goes to the Institute after eight years with the Los Angeles County Road Department.

James E. Czel has been named director of public works in the newly formed Department of Public Works in Westport, Conn. Prior to this appointment, Mr. Czel served as town engineer for Trumbull and Fairfield, Conn.

Robert J. Jackson, Jr., Lieutenant Colonel, Corps of Engineers, has earned his master's degree in engineering administration from George Washington University. Colonel Jackson has served in the Corps of Engineers since 1938.

(*Continued on page 112*)

FRANKI FOUNDATIONS

2 WAYS BETTER

...and this is Why

1. From a dollars-and-cents standpoint, Franki Displacement Caissons can mean savings of both time and money. Due to its different method of installation and resulting high working load capacity, *fewer units of shorter length are required.*

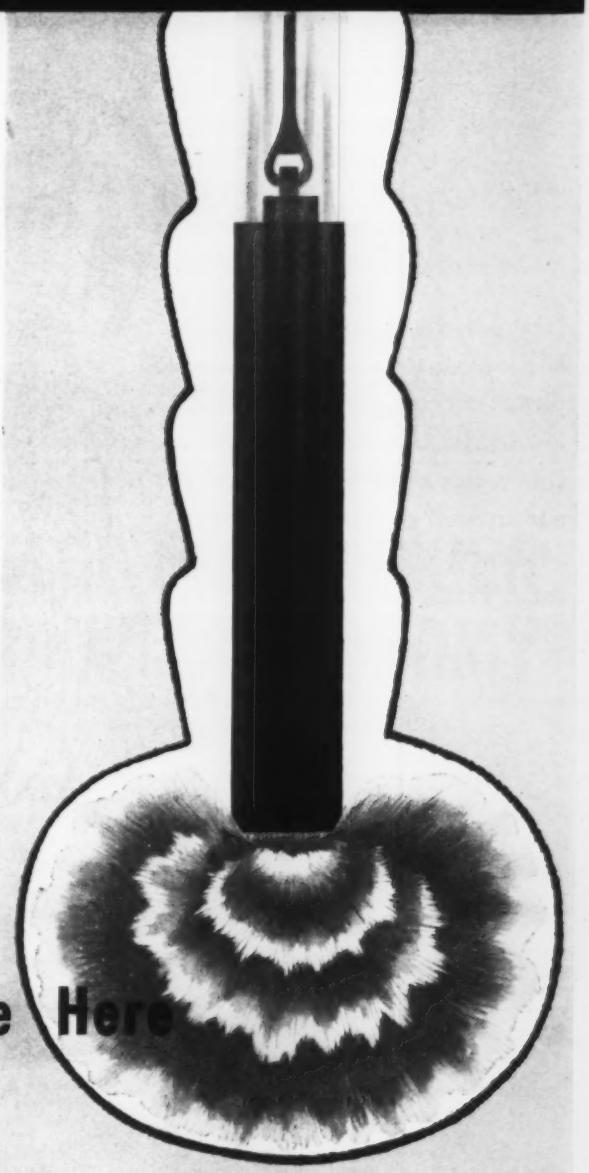
2. From an engineering standpoint, Franki Displacement Caissons take full advantage of the load carrying capacity of the soil. This is accomplished by ramming "dry"* concrete into the base, thus making in reality a pressure injected footing which, in turn, is surrounded by a compacted soil mass.

Unlike old-type or conventional pedestal piles, Franki bulb-like footings are "forged." Instead of poured concrete, they are made of "dry" concrete compacted by falling ram blows of approximately 140,000 foot pounds.

The "DRY"* CONCRETE Makes The Difference Here

Before you draw up specifications for the next foundation, be sure to investigate the advantages of the *different* Franki Displacement Caisson. At your request, a Franki engineer will call to explain all details and show examples of how Franki saved both time and money on various projects. Write or phone.

*"Dry" concrete is defined as zero slump concrete using approximately 3½ gallons of water per bag of cement.



The high driving force of 140,000 foot pounds per blow of a falling ram, many times greater than the blow of a steam or of a pneumatic hammer, "forges" the different Franki injection type footing from "dry" concrete. It also compacts the surrounding earth to exploit the maximum bearing capacity of the soil.

FRANKI FOUNDATION COMPANY

103 Park Avenue
NEW YORK 17, N. Y.
MUrray Hill 5-8916

Statler Building
BOSTON 16, MASS.
HAncock 6-0010

Successful bidder on 19 earth-fill dams

"Our Allis-Chalmers equipment has proved it can move more dirt at low cost . . . and let us be low bidder time after time. It gets a full share of credit for our success," says **Joe Duncan** of Arnett & Duncan, Corsicana, Texas.

TS-360 motor scrapers (15 yd struck; 20 yd heaped), like that shown at the left, are the big guns of the Arnett & Duncan fleet on earth-fill dam construction. Working with the TS-260's (11 yd struck; 14 yd heaped), they help make a high-production, low cost-per-yard team.

7,000 cu yd per day

. . . that's the kind of earth-moving production Arnett & Duncan get from their spread of Allis-Chalmers motor scrapers and crawler tractors.

Working on 1,000 to 1,200-ft hauls, the TS-360 and TS-260 motor scrapers are loading, hauling and dumping tough-to-handle waxy clay with 30 percent sand on a bed of shale. Even in this rough material, which normally slows down production, the Allis-Chalmers units have been cutting cycle time. The curved bowl bottom with offset cutting edge brings a real boost to loading cycles. Incoming dirt breaks up and rolls into the bowl, filling it with heaped loads . . . faster.

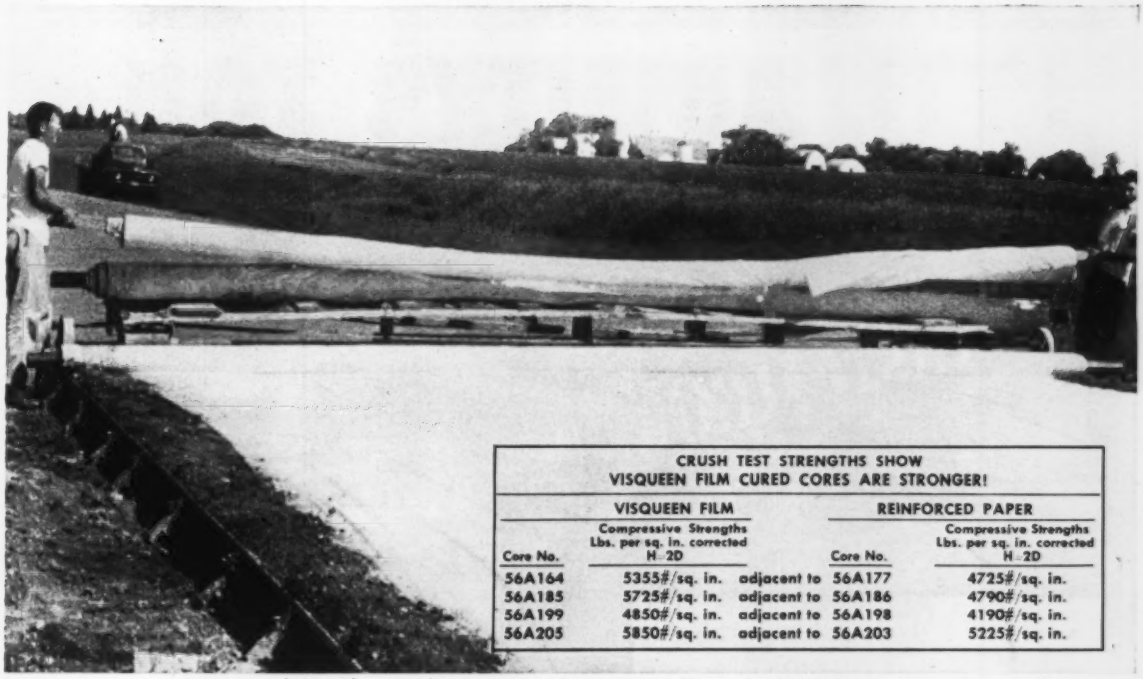
Lower cost per yard

Joe Duncan reports that his Allis-Chalmers equipment can dig, haul and place dirt for a lower-per-yard cost . . . move as much dirt as higher-rated capacity units.

"Our operators like our Allis-Chalmers equipment, too, because of the operating ease, riding comfort. You get a lot more production when the crew likes the equipment," adds owner Duncan.

Find out for yourself how productive Allis-Chalmers construction machinery can help improve your profit picture on a wide range of land improvement work. Ask for all the facts—and a working demonstration of real dirt-moving efficiency. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Look ahead...*move ahead* with ALLIS-CHALMERS



CRUSH TEST STRENGTHS SHOW VISQUEEN FILM CURED CORES ARE STRONGER!

VISQUEEN FILM			REINFORCED PAPER	
Core No.	Compressive Strengths Lbs. per sq. in. corrected H-2D		Core No.	Compressive Strengths Lbs. per sq. in. corrected H-2D
56A164	5355#/sq. in.	adjacent to	56A177	4725#/sq. in.
56A185	5725#/sq. in.	adjacent to	56A186	4790#/sq. in.
56A199	4850#/sq. in.	adjacent to	56A198	4190#/sq. in.
56A205	5850#/sq. in.	adjacent to	56A203	5225#/sq. in.

Core strength tests show results obtained with VISQUEEN film curing blankets.

"VISQUEEN" FILM GIVES STRONGER CURES WITH GREATER ECONOMY

TRADEMARK

LOW FIRST COST—plus as many as 23 re-uses cut blanket costs to a fraction of a cent/sq. ft.

LOWER LABOR COSTS result because white opaque VISQUEEN film is far lighter, hence easier, more speedily handled. 1000 sq. ft. of .004″ thickness weighs 20 lbs. And white opaque VISQUEEN film curing blankets *stay* light. Will not absorb moisture.

TIME SAVING: When using VISQUEEN film curing blankets, additional watering is not necessary. The film rolls up easily—needs no drying or special handling. Will not rot or mildew. Inert—no chemical reactions with concrete—leaves no deposit on slab.

ONLY VISQUEEN film comes in standard widths—or blankets—*seamless* widths up to 32′. Available in 14′ roll widths with no folds.

ADDITIONAL USES of VISQUEEN film: rain blankets, equipment and material covers.

Write now—or use the information request tag below for full information on how VISQUEEN film can do your job better at less cost.

information request tag

VisQueen

Trade Mark

clip this tag—#CV4

attach to letterhead, mail.

VISQUEEN *film—the first and foremost polyethylene film. A product of the long experience and outstanding research of* **VISKING COMPANY** *Division of* UNION CARBIDE *Corporation*
P. O. Box 1410, Terre Haute, Indiana
In Canada: VISKING COMPANY, DIVISION OF UNION CARBIDE CANADA LIMITED, Lindsay, Ontario.

VISKING and VISQUEEN are registered trademarks of Union Carbide Corporation.

ABILITY . . .

6 reasons why Cast Iron Pipe is #1 choice of U. S. A.

1. **HIGH FLOW CAPACITY . . .**
   Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
2. **LONG LIFE . . .**
   42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
3. **BEAM STRENGTH . . .**
   Cast Iron Pipe is inherently tough . . . stands up under heavy traffic load, soil displacement and disturbance.
4. **EXTERNAL LOAD RESISTANCE . . .**
   6" Class 150 Pipe withstands a crushing load of 17,900 pounds per foot . . . nearly 9 tons.
5. **CORROSION RESISTANCE . . .**
   Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
6. **TIGHT JOINTS . . .**
   A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available for all conditions.

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
Suite 3440, Prudential Plaza, Chicago 1, Ill.

MODERNIZED **cast iron**

NOT PROBABILITY!

Cast Iron Pipe's record of maintaining high flow capacity throughout its long life is FACT not FICTION!

Carrying capacity without strength is like running a rickety car with a powerful engine . . . sooner or later it will shake apart.

Why choose between high flow, strength and long life when cast iron pipe gives you *all* of them?

Specify America's #1 pipe and your water system will serve long after the bond issue is retired.

* *Here is the proof!*

FLOW FACTORS FOR CEMENT LINED CAST IRON PIPE

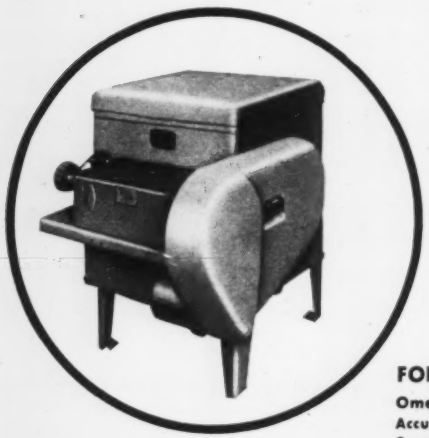
LOCATION	SIZE	TEST SECT. IN FEET	VELOCITY F.P.S.	AGE YEARS	W & H "C" FACTOR
Bowling Green, Ohio	20"	45,592	0.7-2.4	New	142.5
Chicago, Illinois	36"	7,200	2.6-3.6	New	147
New Orleans, La.	12"	39,650	1.2-2.9	New	141
Corder, Mo.	8"	21,350	0.9-2.3	New	143
Univ. of Illinois	8"	400	3.14	New	150
Concord, New Hamp.	14"	500	1.7-2.2	New	151
Concord, New Hamp.	12"	500	2.0-3.4	11	142
West Palm Beach, Fla.	12"	500	3.6-5.4	15	139.5
Greenville, S. C.	30"	87,376	2.4-2.7	12	148.5
Corpus Christi, Tex.	30"	65,641	1.1-1.8	6	146
Summerville, S. C.	8"	500	1.98-2.43	13	142.5
Champaign, Illinois	16"	3,920	3.1-5.6	22	139.3

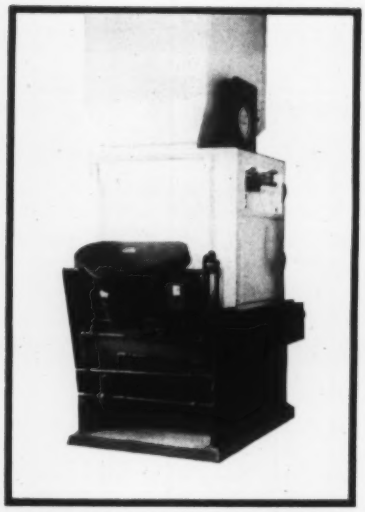
*Available upon request: Booklet containing flow test and tables on Cast Iron Pipe.

pipe FOR MODERN WATER WORKS

FEEDING LIME?

...It's Omega Time!





FOR FEEDING AND SLAKING QUICKLIME IN LARGE PLANTS

Omega Lime Slaker with Loss-In-Weight Feeder

Accuracy — within ±1% of set feed rate (by weight)

Capacity — 50 to 12,000 lbs./hr.

Feed range — up to 100 to 1 on feeder . . . 10 to 1 on slaker

FOR FEEDING LIME SLURRY IN LARGE PLANTS

Omega Rotodip Liquid Feeder

Accuracy — within ±1% of calibrated rate

Capacity — maximum rates up to 1800 gph

Feed range — up to 100 to 1

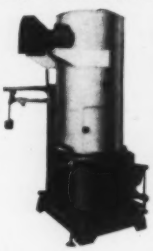
FOR FEEDING HYDRATED LIME . . .

Omega Loss-In-Weight Feeder, Model 30

Accuracy — within ±1% (by weight) of set feed rate

Capacity — up to 2000 lbs./hr.

Feed range — as high as 100 to 1 if necessary



Omega Universal Feeder

Accuracy — within ±3% to 5% by weight

Capacity — 3 sizes for feed rates up to 5000 lbs./hr.

Feed range — up to 40 to 1 for any specific application

Omega Model 50A Disc Feeder

Accuracy — within ±3% to 5% by weight

Capacity — from 20 to 1700 cu. in./hr.

Feed range — up to 10 to 1 . . . any one of three change gears.

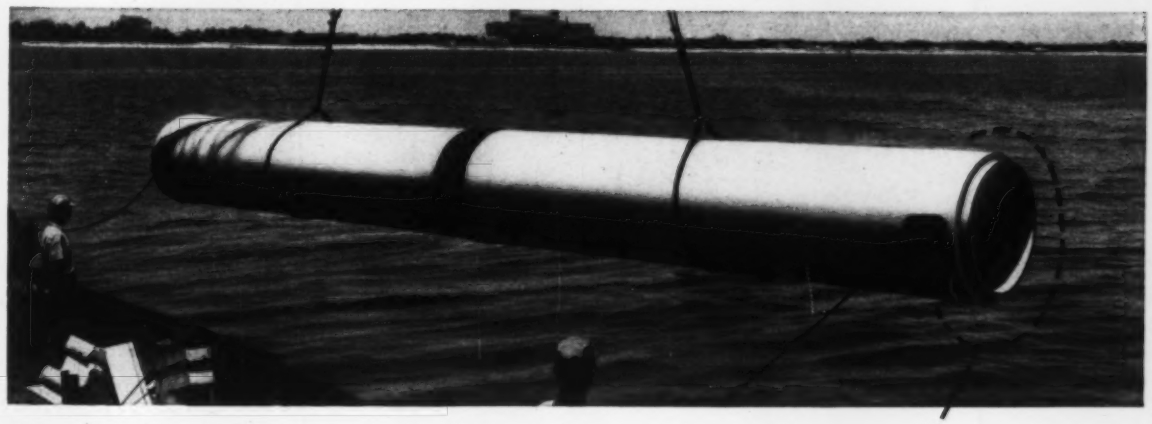
If you're feeding lime . . . quicklime, hydrated lime or dolomite, as a slurry or dry, at low or high rates . . . and want to do it economically, accurately, and dependably . . . investigate the advantages of Omega Feeders. For specific recommendations, send complete details of your feeding requirements . . . to

Omega Machine Co., 360 Harris Avenue, Providence 1, R. I.

OMEGA MACHINE CO.
DIVISION OF
B-I-F INDUSTRIES BIF METERS FEEDERS CONTROLS

LONG

LENGTH CONCRETE PIPE

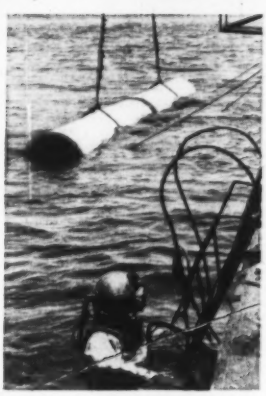


with **TIGHT** STEEL and RUBBER **AMSEAL® JOINTS**

Whether you want to keep water in or out—or both—American-Marietta long length concrete pipe with Amseal joints will do it better at less cost. In fact, the Engineer on the above job says, "The original design called for 24″ diameter pipe of another type but 30″ Amseal Subaqueous Pipe proved more economical."

The longer lengths enable a contractor to install 32 feet of pipe—often 64 feet—at a time. This means less handling and joint making . . . improved flow capacity through use of fewer joints.

The "pressure proven" rubber and steel Amseal joint provides a flexible but positive water-tight seal against costly infiltration or leakage. For underwater work subaqueous connections are provided to simplify installation. Write our technical staff for assistance with your pipe problems.

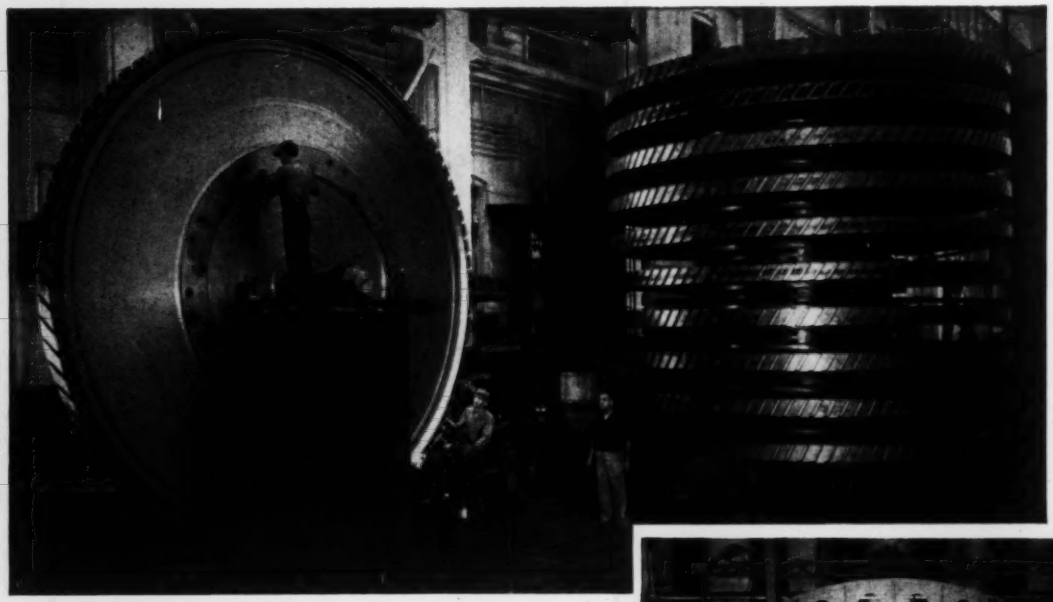


Subaqueous ocean outfall line at Palm Beach, Florida. Engineer: Norman C. Schmid & Assoc., Palm Beach. Contractor: Powell Bros. Co. Inc., Ft. Lauderdale.

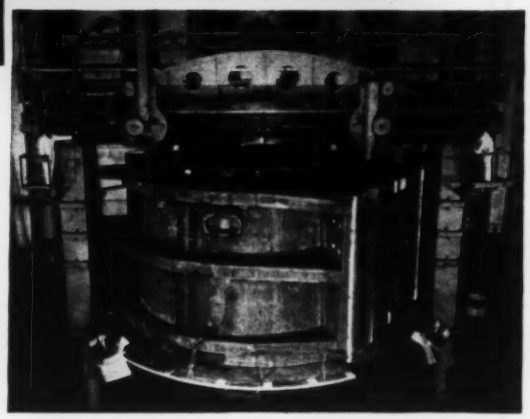
Another example of
PROGRESS IN CONCRETE

TRADE-MARK REG. U. S. PAT. OFF.

AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION
GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600



Rotor discs for mammoth 11-stage compressor were balanced and stacked for alignment in one of Newport News' five huge machine shops. Large engineering and technical staffs with a vast plant make Newport News an ideal source for large equipment . . . *standard or special in design.*



A 35-foot boring mill in Newport News' plant machining the 374,000-pound upstream housing for the giant axial flow compressor. The compressor is heart of an 8-foot supersonic wind tunnel at the Ames Aeronautical Laboratory of the National Advisory Committee for Aeronautics at Moffett Field, Calif.

To create winds exceeding

2000 MPH

Newport News builds world's Mightiest Compressor

Whenever you want large units built with careful attention to detail, give the job to Newport News.

This company recently built an eleven-stage axial flow compressor that shatters all previous records for wind force . . . using what is believed to be the world's largest rotating object.

The rotor, weighing more than 400 tons, comprises eleven huge discs. Each disc, machined from a 96,000-pound forging, was finished to a 50,000-pound wheel and balanced to within 26 ounces at the rim. In each rim, slots for blades were machined to within .005″ on special milling heads designed and produced in the Newport News plant.

Here at Newport News, you'll find more than large productive capacity. In machine shops, foundries and forging plants Newport News craftsmen complete your orders with specialized techniques backed by experience in fabricating thousands of products.

Newport News' craftsmen produce units that range from small components of spinning machines, to mammoth hydraulic turbines . . . from piping, pumps and valves, to vacuum tanks, digesters and bridge caissons.

These skilled men handle the job exactly as you want it done, for maximum results per dollar invested. So let us bid on your present or future projects. Learn how Newport News can help you. Send for our illustrated booklet entitled, "Facilities and products" . . . it's your for the asking.

Newport News

Shipbuilding and Dry Dock Company

Newport News, Virginia

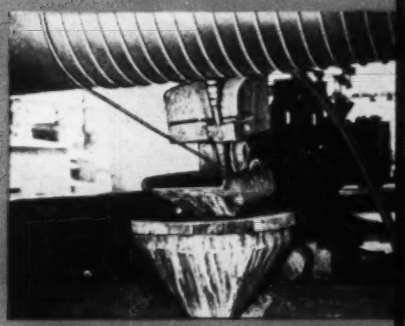
improving a superior product

American Concrete Cylinder Pipe has long been established as one of the outstanding developments in the field of pressure transmission of water. This superior design combines the physical properties of steel with the structural and protective properties of concrete — producing a pipe of great strength and long life. Important transmission lines of American Concrete Cylinder Pipe are today serving most of the major cities and population centers in the western United States.

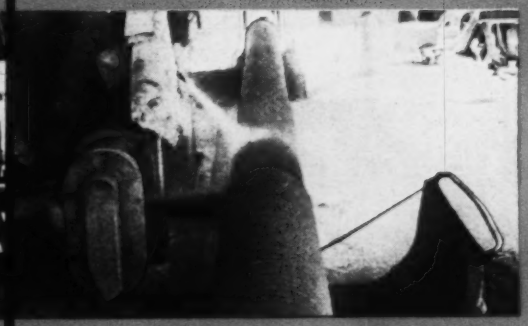
Through the years, continuing research has led to improved features in the manufacturing process. These features enrich the alkaline environment surrounding the steel components, which environment is so necessary to the continuing and everlasting protection that well-made concrete gives to this high quality pressure pipe.

Specify these plus-factors featured by American — where research, development and quality control are always striving to make high quality products even better.

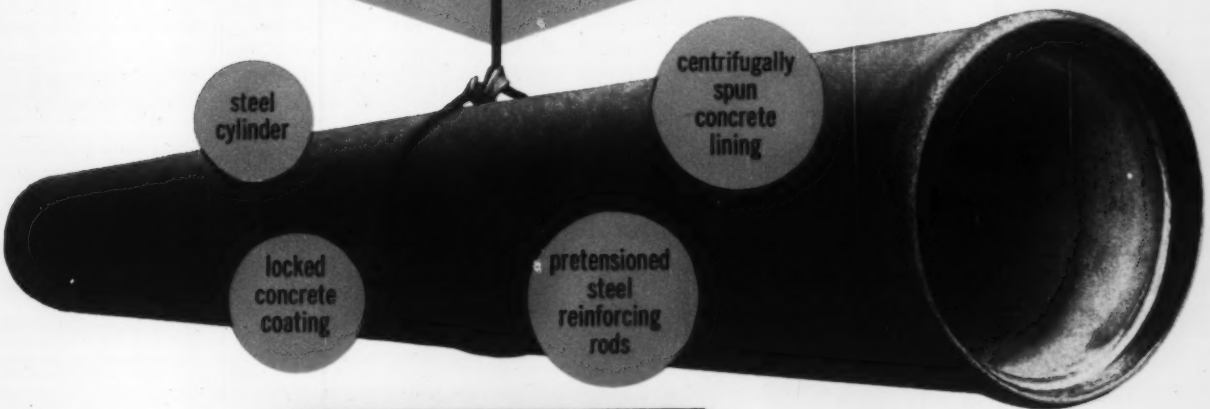
American Concrete Cylinder Pipe is available in a diameter range of 12" through 60" I.D. and in standard lengths of 32 feet.



Rich cement wash applied to steel reinforcing rod just before it is wound under measured tension and with accurate spacing around concrete lined cylinder provides positive assurance of a highly alkaline environment between surfaces of cylinder and circumferential reinforcement.



An additional rich cement wash over the entire outer surface of the pretensioned steel cylinder before application of the pipe's dense mortar coating assures maximum alkaline environment where it is most needed.



American PIPE AND CONSTRUCTION CO.

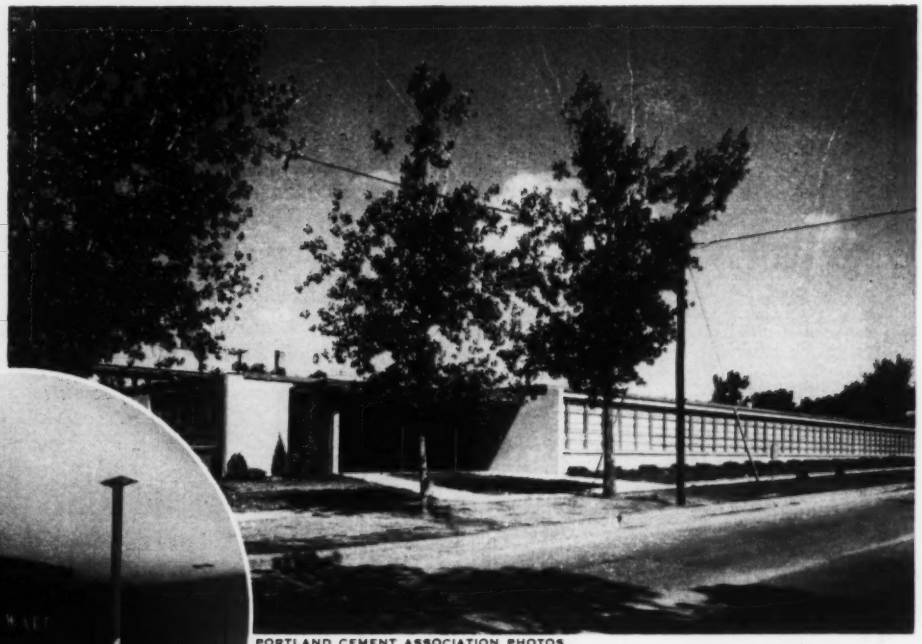
Los Angeles: 4635 Firestone Blvd., South Gate, Calif., LOrain 4-2511

Hayward: P.O. Box 630—JEfferson 7-2072

San Diego: P.O. Box 13—CYpress 6-6166

Phoenix: 2025 South 7th St.—ALpine 2-1413

Portland: 518 N.E. Columbia Blvd.—BUtler 5-2531



North Ward School

PORTLAND CEMENT ASSOCIATION PHOTOS

For Low Cost Beauty

Architectural Concrete and Concrete Masonry made with Ideal Cement provide a BEST BUY for Schools

An economical dual application of concrete was developed for the construction of the North Ward Elementary School in Superior, Nebraska. On both the inside and outside of this handsome school building, concrete walls were left exposed.

Architectural concrete exterior walls provide an attractive, low-annual-cost exterior treatment for the entire building. On the inside, lightweight concrete masonry walls fulfill a load-bearing as well as a decorative purpose. The interior ceiling was constructed of exposed concrete filler-blocks to provide additional economies when used with the thin concrete roof slab.

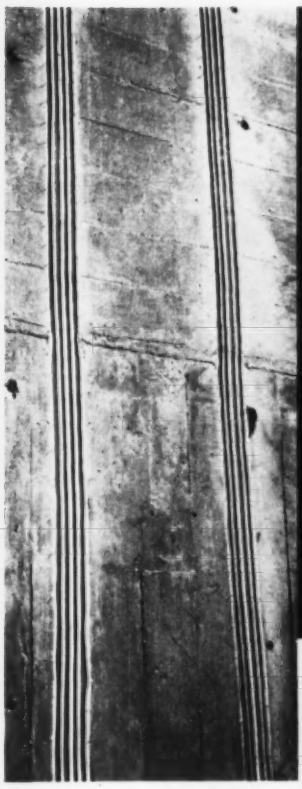
This unique school building provides a total of 22,750 sq. ft. of space at a cost of $11.33 per sq. ft.—is an outstanding example of the way architectural concrete and concrete masonry provide beauty, economy, and long life with minimum maintenance. Ideal Cement was used exclusively for all concrete and concrete masonry units in North Ward Elementary School.

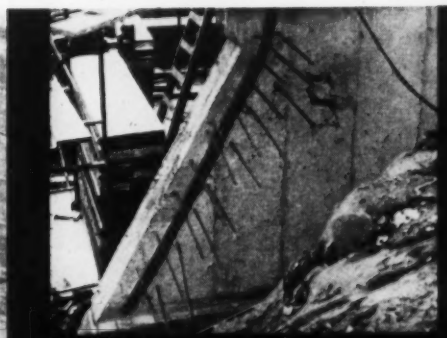
PORTLAND IDEAL CEMENT

IDEAL CEMENT COMPANY

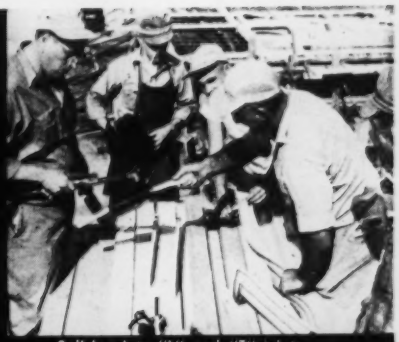
DENVER, COLORADO

15 Plants and 4 Terminals Serving
Some of the Most Rapidly Growing Areas of the Nation





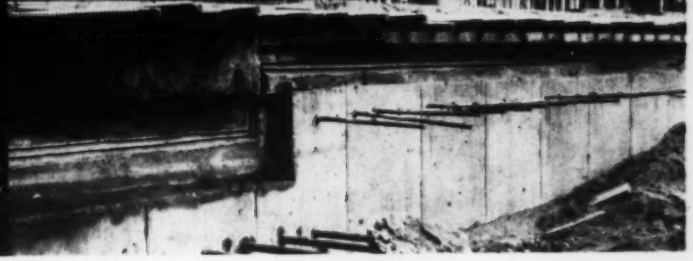
Foundation joint . . . Water Seals can be used virtually anywhere.



Splicing into "L" and "T" joints. All it takes is a hot knife.

Vertical Joint ready to receive second pour of concrete.

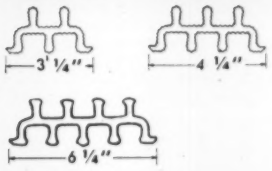
Indented pour. Normal agitation fills corrugated ribs.



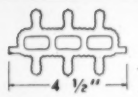
STOP WATER WITH WATER SEALS

The First and Finest Waterstop!

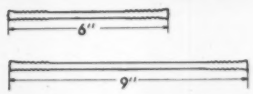
LABYRINTH



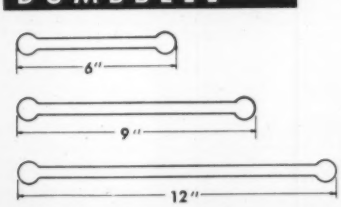
CELLULAR



FLEXTRIP



DUMBBELL



Years of experience with the use of Water Seals products in projects such as dams, skyscrapers, parking lots, swimming pools and countless others, give background to the opinion that Water Seals do amazingly well at their job of stopping water and are the finest waterstops available. Water Seals insure an exceptionally strong labyrinth bond between pours of concrete . . . yet one which will accommodate exceptional horizontal and vertical movement.

Produced by the world's largest plastics manufacturer, flexible polyvinyl plastic used in Water Seals is resistant to age, chemical and weathering changes through the years. Vital Plasticizers won't "bleed out" . . . provide constant protection against water seepage even in the most critical joints. Cut or splice in any length. Prefabricated fittings also available. *All Big reasons why you should consider Water Seals waterstops.*

WATER SEALS, Inc.

9 SOUTH CLINTON STREET **CHICAGO 6, ILLINOIS**

Made in Canada for J. E. Goodman Sales Ltd. Toronto, Ontario

Send for a Sample Section - and Descriptive Literature

WATER SEALS, Inc. Dept. 1
9 South Clinton Street
Chicago 6, Illinois

Gentlemen: Please send me free samples and descriptive literature on Water Seals.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Built-in optical plummets eliminate plumb bobs save set-up time...improve accuracy

Gurley OP-57

Gurley OP-137

The Gurley Optical Plummet Transit (Model OP-57) has proved itself to be such an important time and money saver in the field that this optical plummet feature has also been added to the Model 132 Standard Precise Transit. The new transit will be known as the OP-137.

Both these Optical Plummet Transits will save you time and trouble in setting over a point. The OP-57 and OP-137 eliminate the swing and sway of the cord and plummet—exasperating and time consuming. You will especially appreciate the increased accuracy on windy locations.

By rotating the instrument 180°, you can be assured of positive centering.

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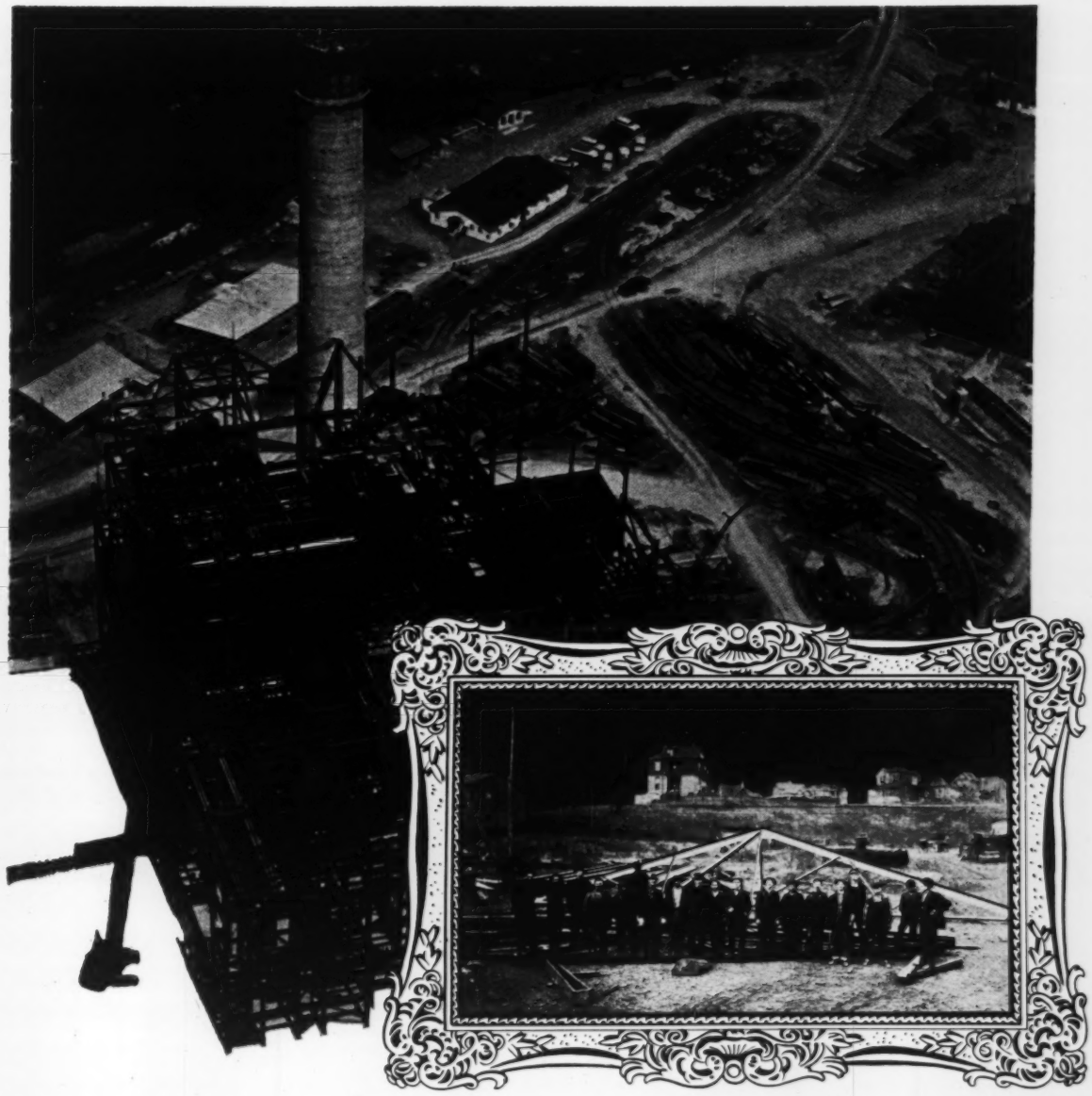

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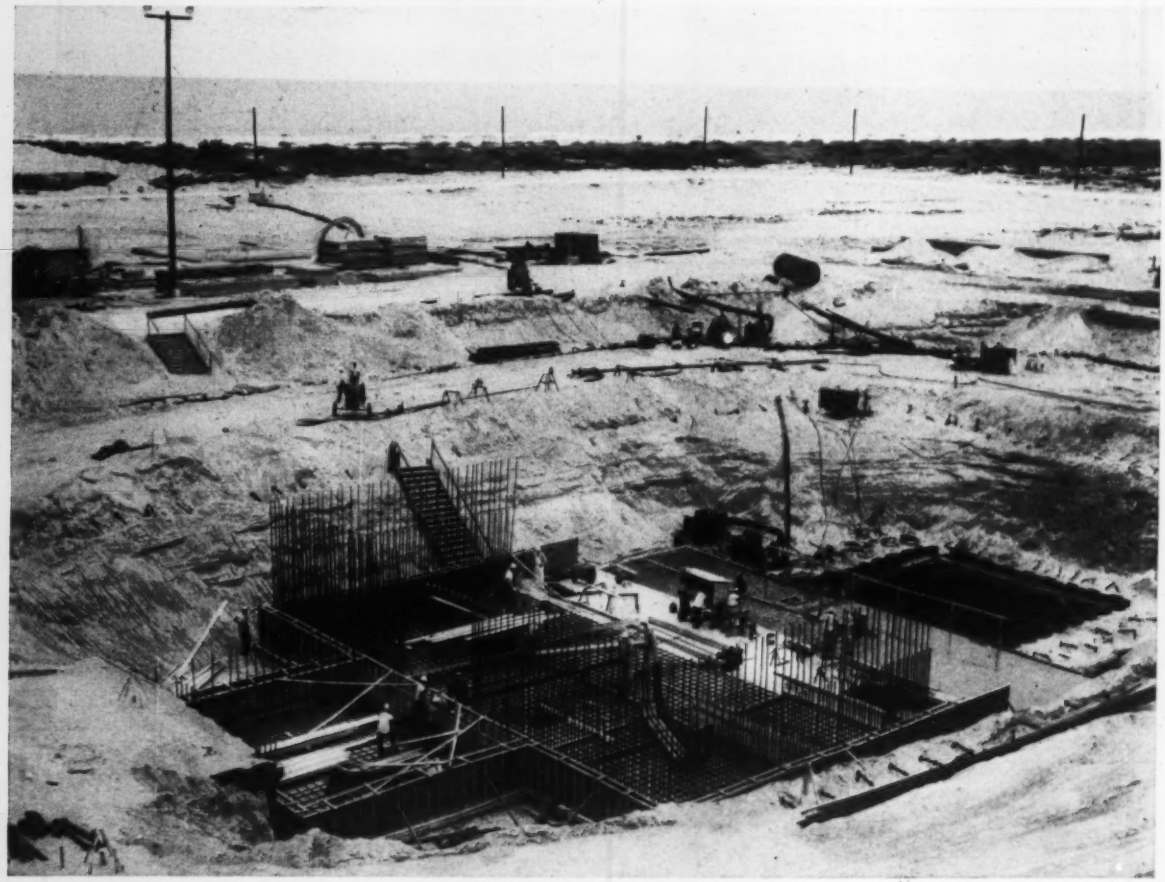

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Dewatering Speeds Progress at Cape Canaveral

Speed was urgent on this guided missile launching site. Confronted with numerous construction problems, the contractor decided to sublet his difficult dewatering operation.

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In May — Ten good articles on electronic computation: philosophy, techniques, and hardware

. . . . . *Am-Soc Briefs*

▶▶ Dateline Chicago. . . . Out of the deliberations of the Board of Direction the Society develops. . . . Significant decisions reached in Chicago include the authorization of commercial exhibits for all ASCE Annual Conventions regardless of where they are held. . . . Important also was the decision to form a Committee on Publications in the Department of Conditions of Practice. The new committee will edit the Journal of the Board of Direction, now renamed the "Journal of Professional Practice." Members may obtain copies as part of their quota of free papers via the coupon in the advertising section.

▶▶ Looking ahead to summer. . . . The Portland Section -- host to the next Society Convention, June 23–27 -- invites you to the northwest for a "Conventional Vacation." The Oregon–Washington country is famous the world over as a vacation land. The Portland Convention program will appear in the May issue. . . . The Hawaii Section is knee deep in plans for its Post-Convention Tour of the Islands and two-day technical program in Honolulu, June 28–July 7.

▶▶ Big machines have gone into action on United Nations Plaza, demolishing old buildings and clearing the site for the new United Engineering Center (page 76). With the goal of industrial giving over half completed, the sixteen engineering societies that will occupy the building are hopeful of moving in sometime in 1960. . . . As chairman of the Society's campaign for member gifts, Past-President Needles discusses (on page 45) the clear-cut obligation of ASCE, as oldest of the national engineering societies, to set the pace in financing the Center.

▶▶ Recession or no recession, the news on the salary front is still good. The Society's fifth quarterly Engineering Salary Index continues to show some areas where salaries are still climbing and others where they have remained at past-quarter levels.

▶▶ Welcome -- and hearty congratulations -- to the newly authorized New Hampshire Section, seventy-sixth on the list of ASCE Local Sections; to the East Coast Branch of the Florida Section; to the Colorado Springs Branch of the Colorado Section; and to the Redwood Empire Branch of the San Francisco Section.

▶▶ In and about Civil Engineering. . . . This is another reminder that each member is entitled to a free copy of the 1957 Index. A request to the Executive Secretary (by postcard, if possible) will bring you a copy. . . . Presentation of the first of the ASCE plaques honoring the Seven Civil Engineering Wonders of the United States was made to the Chicago sewage disposal system in February (page 85). . . . The forthcoming (May) issue will be devoted to high-speed electronic computers.

8 more jobs prove Foster Pipe Piles

Walnut St. Bridge, Wilmington, Del.
A. S. Wilkstrom Inc., Skaneateles, N.Y.

Florida Power and Light Co. Plant
Murphy Construction, Palm Beach

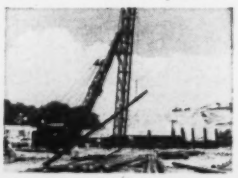
New York Thruway Connecting Link
Carlo Bianchi & Co. Inc., Framingham

Jersey City Sewage Treatment Plant
Garden State Constructors & Assoc.

Brazos River Bridge, Hearne, Tex.
J. A. Raines Construction Co., Okla.

Mississippi River Bridge, Lansing, Ia.
Brennan Brothers, LaCrosse, Wis.

Connecticut Turnpike Feeder
C.W. Blakeslee & Sons Inc., New Haven



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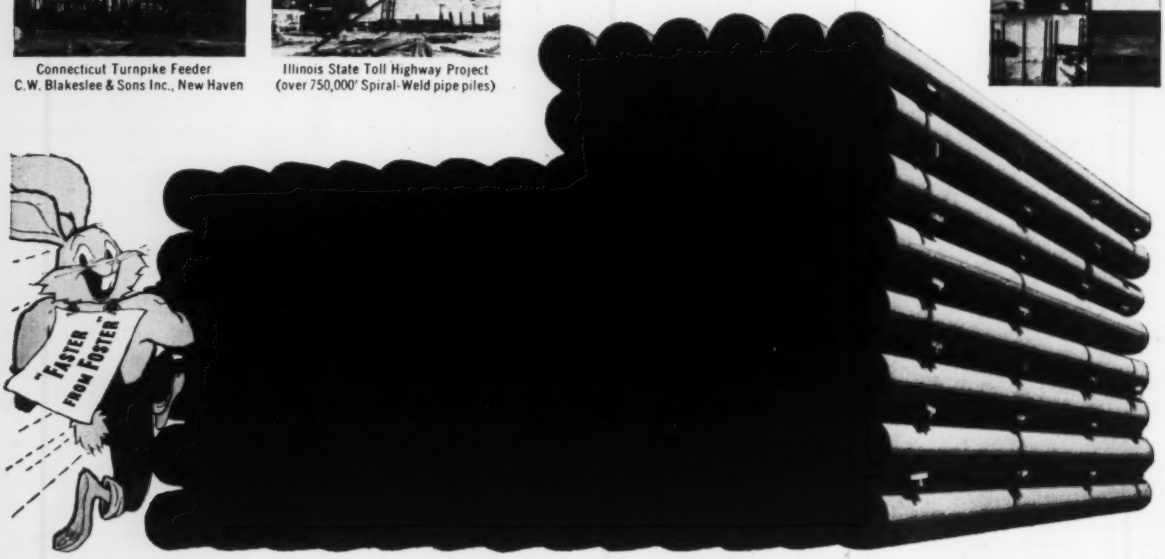

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do you know that

More than 100 mgd of raw sewage was treated before discharge into metropolitan New York waters in 1957? This was the direct result of completing over $85,000,000 worth of treatment projects, the Interstate Sanitation Commission reports. The Commission's current clean-up program includes $150,000,000 worth of projects, which will treat an additional 300 mgd of raw sewage. The Commission is concerned with metropolitan area waters of New York, New Jersey, and Connecticut.

• • •

West Berlin is building a 200-mile expressway system? For the past year and a half work has been under way on a $250,000,000 limited-access network that includes a 25-mile circumferential highway around the city, 35 miles of tangential roads, and many miles of approach highways. Erwin Klotz, director of the expressway construction work in West Berlin, was a member of a Highway Study Team that recently visited the United States.

• • •

Solar heating of homes is possible even in northern climates? This is the consensus of M.I.T. engineers, who have just completed a full-scale sun-heated house in the Boston suburb of Lexington. However, the solar collector will supply only 75 to 80 percent of the needed heat. In chilly New England full-scale heating by the sun is possible but not practical, according to Prof. Lawrence B. Anderson, chairman of M.I.T.'s Space Heating Committee. After twenty years of research, the committee sees the initial cost of the collector and other equipment as the only drawback to solar heating for the average home.

• • •

Work on the multi-billion-dollar highway program is increasing rapidly? In the nineteen months since the program got under way, a total of $3 billion has been authorized or spent for preliminary engineering, right-of-way acquisition, and construction, and an additional $1.2 billion has been earmarked for specific projects. Tangible accomplishments are 3,323 miles of road, which have been advertised, gotten under way, or completed. The status of work is summarized in the annual report of the Bureau of Public Roads, on sale by the Superintendent of Documents (Washington 25, D. C.) at 30 cents a copy.

• • •

Despite improved safeguards, on-the-job accidents still occur? In 1956 nearly 2,000,000 workers were disabled, and over 14,000 were killed on the job. The President's Tenth Anniversary Conference on Occupational Safety, which is being held in Washington this spring, will tackle the new challenge of protecting our labor force from the technological hazards of the Space Age.

• • •

The job market for 1958 college graduates will be tighter? On the basis of cancellations of recruiters' visits to Eastern campuses, the consensus is that over-all hiring of graduates may be down as much as 25 percent. Engineers and majors in chemistry, physics, and math are still the preferred men. However, Carnegie Tech, voicing the view of many, reports that it "expects to place maybe 70 percent" of its engineering and science seniors by June this year. Last year all were placed by June. Paradoxically (and fortunately) starting pay will be the same or a little better than last year, with $460 to $465 the estimated average.

• • •

A new Chesapeake Bay crossing is under study? To all who have been delayed in their travels by the notorious Kiptopeke Ferry bottleneck, it will be good news that the Virginia Highway Department has approved plans for a bridge-tunnel linking the eastern shore of Virginia with the Norfolk area. The 17-mile project is now before the Army Corps of Engineers. Wilbur Smith & Associates are the traffic engineers, and Sverdrup & Parcel are making projections of construction costs. Preliminary estimates put the cost at $140,000,000.

• • •

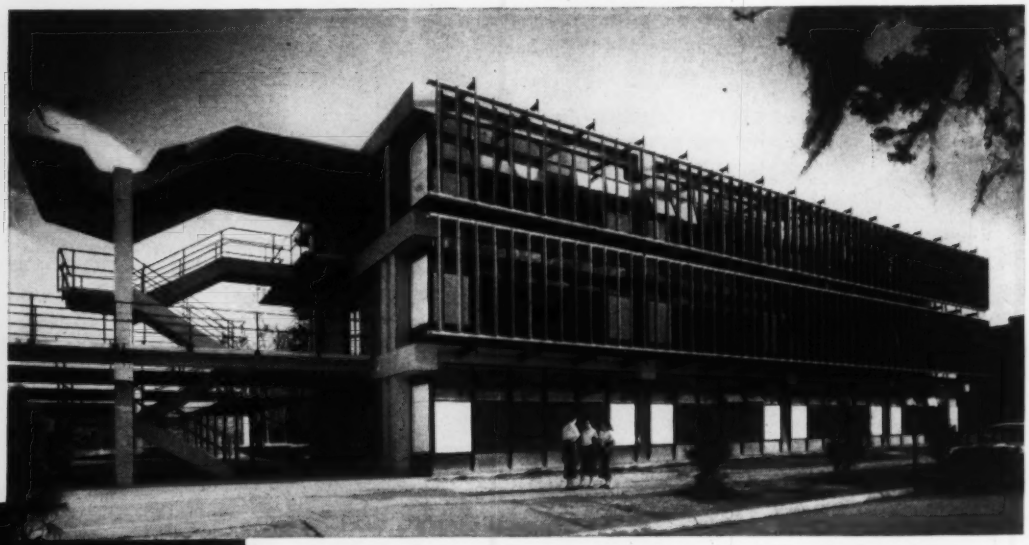
Engineering is one of the largest professions? Exceeded in size only by teaching and nursing, for men it actually *is* the largest profession. In 1956 there were about 700,000 engineers in the United States. Getting down to civil engineers, about half of them are employed by federal, state, and local government agencies. The second largest group is in the consulting field. Many interesting facts on occupations are available in the Department of Labor's 1957 Occupational Outlook Handbook, for sale by the Superintendent of Documents at $4.00 a copy.

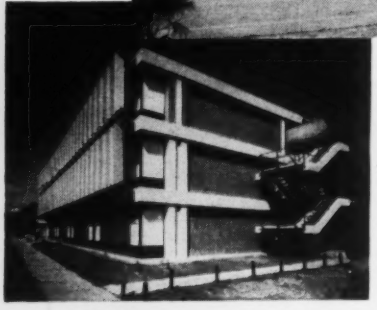
• • •

Brooklyn Bridge is seventy-five years old? When the famous bridge was completed in May 1883, it was the engineering marvel of the century—the longest single span ever built, the tallest and strongest, and the first suspension bridge in the world to use steel cables and trusses. It was the crowning work of John and Washington Roebling, father and son, both masterbuilders. Recently the historic structure was strengthened and modernized under supervision of one of today's daring bridge builders, D. B. Steinman.

BOLD NEW DESIGN

for a Fine Old Tradition





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Three interconnected buildings comprise the student union, housing the college bookstore, post-office, snack bar, ballroom and other recreational facilities.

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CIVIL ENGINEERING

United Engineering Center . . . symbol of service

ENOCH R. NEEDLES, Past President, ASCE

President, Engineers Joint Council; Chairman for ASCE, Member Gifts Campaign

Howard, Needles, Tammen & Bergendoff, Consulting Engineers, New York, N. Y.

After several years of hoping and planning, our wonderful United Engineering Center in New York is taking definite shape and becoming a reality. The land for this project has been acquired and is being cleared preparatory to actual construction. Very substantial contributions toward the cost of this $10,000,000 undertaking have been made and the prompt completion of this symbolic structure is assured.

In the broad profession of engineering there are three notable names which signify cooperative effort and successful accomplishment on the part of our great national engineering societies:

First, there is United Engineering Trustees, Inc., founded 54 years ago to operate and manage joint properties of the Founder Societies.

Second, we have Engineers' Council for Professional Development, whose 25th Annual Report has recently been issued. This council is called "a conference of engineering bodies," eight in number, having to do most spectacularly with the accreditation of engineering curricula in our engineering colleges and universities.

Third and last, there is Engineers Joint Council, which came into being about 15 years ago and which has now grown into the common meeting ground for discussion and joint action on common problems for 17 engineering organizations with individual memberships totaling over 250,000.

Why do I, as a civil engineer, give you these three great names? The answer is simple. Every time I see the listing of the names of the professional societies which make up the membership of these three cooperative groups I take great pride in the fact that the American Society of Civil Engineers heads every list. Very quickly it is realized that the societies are listed in the order of seniority, and of course ASCE was the first national society of engineers to be founded in the United States, 106 years ago. So we are wholly justified in our pride that the name of our Society heads every listing.

But now comes the realization of the responsibility which is ours as front-ranking engineering Society of our nation. To the leader goes the opportunity and the obligation to act as leader. Happily, in the broad range, the American Society of Civil Engineers has always functioned as a leader should, and I am sure it always will. The support we will bring to the building of our new United Engineering Center, facing on the world famous United Nations Plaza, will be wholly typical of the support we Civil Engineers will always give toward basic unity within our noble historic profession.

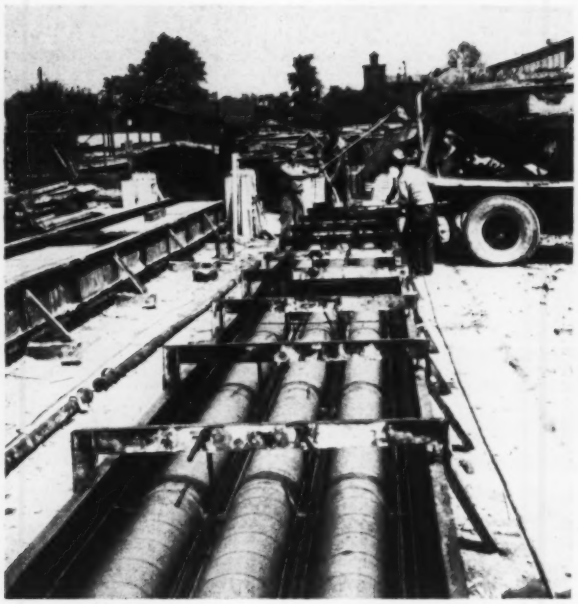
In United Engineering Trustees, to whom we have delegated the detailed job of actually building our new Center, we fully recognize that each constituent society has a definite individuality and program of activity peculiar to itself. Sometimes we find ourselves very zealous guardians of the status and prerogatives of our own particular Society. However, all of us have an inherent affection and respect for the broad profession of engineering, and in the building of this Center we find expression for those thoughts.

This new Center is to be more than a building. It is to be a symbol of the constructive builder, the engineer—of service to his fellow man and to his nation. This Center will be a tangible expression of our pride in our unified profession. The building itself will become a great material testimonial to the public of our idealism—our faith in and enthusiasm for engineers and engineering.

It is my sincere hope that every member will share with me a compelling desire to visit this Center some day. Then, I am certain, each will look on this inspiring structure with the same warm affection and satisfaction we all experience in the practice of our chosen profession.

When the opportunity comes to make a modest contribution to this great joint effort by all engineers everywhere throughout our nation, I know that each one will respond appropriately.

Prestressed precast panels were used in retaining walls up to 50 ft high along cut in Manhattan approach to Lincoln Tunnel. These panels were fabricated in Astoria, Long Island, yard of Precrete Inc., subcontractors to Gull Construction Co. At right, steel forms for these panels are ready for placing of concrete in prestressing bed. At far right, one of these panels is being swung into place between piers in the retaining wall.



FREDERICK C. LOWY, M. ASCE
Consulting Engineer, New York, N. Y.

OFFSITE PRESTRESSING solves tunnel

Prestressing and precasting of structural members away from the site saved time and money in constructing the complex approach and feeder system for the third tube of the Lincoln Tunnel. This facility of the Port of New York Authority joins New Jersey with midtown Manhattan. The third tube and approaches were completed last summer. Since the available construction areas were very congested, the approach structures were planned to permit the maximum amount of work away from the site.

Prestressing was employed in the manufacture of three major elements of the approach structures:

1. Precast panels in retaining walls up to 50 ft high bordering cuts in the Manhattan approach.

2. Precast deck panels, spanning between floor beams, for the new continuous plate-girder bridge across the Pennsylvania Railroad yard near the mid-Manhattan Terminal.

3. Articulated precast panels, designed to bridge a gap and provide additional traffic lanes between existing viaducts, which are part of the New Jersey approach in North Bergen County.

Retaining walls with prestressed panels, as designed for the Manhattan approach to the Lincoln Tunnels, are of the conventional buttress type. Buttresses or piers were constructed by conventional methods about 32 ft on centers, and founded on rock. Recesses were provided on each side of each buttress, and the prestressed panels were lowered into the recesses, which had been padded with expansion-joint filler. A cast-in-place grade beam took the vertical load of the panels. Membrane waterproofing was applied to the rear faces of the panels, and protected by fiberboard.

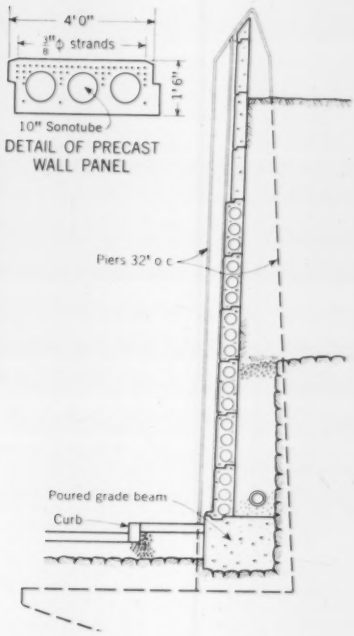
The individual panels are 4 ft wide, 32 ft long, 12 or 18 in. thick, and provided with interlocks. The exposed surfaces show vertical striations. The design provided enough prestressing to sustain lateral pressure corresponding to the height of the fill, a surcharge of 250 psf at the top of the fill, and the maximum head of water that might build up. The stress capacity of the individual panels was varied by varying the number of prestressing strands. The 18-in. panels have three openings of 10-in. diameter through most of their length, formed by fiber Sonotubes, to reduce the weight and the amount of prestressing. See Fig. 1.

While estimated low cost and efficiency in the field were major factors in the decision to use these panels, the pleasing appearance of the finished product yielded an additional bonus. The vertical striations do much to relieve an otherwise dull concrete surface, as do also the massive piers and setback wall units.

These panels were fabricated in the Astoria, Long Island, plant of Precrete, Inc., subcontractors to Gull Construction Company. Steel forms, consisting of base frame and plates, and provided with set screws for adjustment, solved the tolerance problem. The architectural finish was obtained by placing, at the bottom of the form, striated plywood base lining, treated with plastic form coating and light form oil.

A total of 237 panels were cast in face-down position, and steam cured.

FIG. 1. Prestressed panels were used between piers in retaining walls up to 50 ft high along cuts of Manhattan approach to Lincoln Tunnel.



approach problems

Prestressing strands were cut at the required concrete strength of 3,500 psi. Slabs were shipped lying flat, and tilted up for erection. To lift a panel, a choker sling was belted around it at mid-span, and tag lines were attached to lifting hoops, provided on the upper face. After the crane had lowered the panel into the pier slots, the sling was removed by pulling up slightly on the lifting hoops, which were burned off after final setting.

Tests were performed on three slabs to check the engineer's prediction as to cracking load and ultimate load. A concentrated load produced by the application of a single hydraulic jack was applied at midspan. In every instance the loads at cracking and failure were at least as great as those predicted, and substantially better results were obtained on the panels with the heaviest prestress. Total absence of shear cracks in the vicinity of the supports was of special interest, as was the disappearance of the bending cracks after removal of the cracking load. Slabs failed under a bending moment averaging 3½ times the design moment. The first cracks appeared at a loading equivalent to twice the design moment.

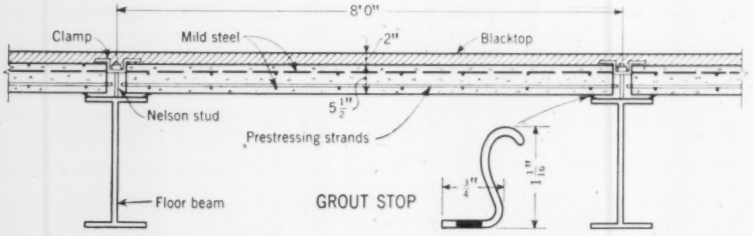
Precast deck panels

At the southerly end of the Manhattan approach, a four-lane continuous plate-girder bridge carries the tunnel traffic across the busy Pennsylvania Railroad Terminal yard from 31st to 33d Street. The steel framing consists of main girders and floor beams spaced 8 ft on centers. Numerous restrictions were placed by the railroad on the method of constructing the bridge. The owner was primarily concerned that proper precautions should be taken to guarantee the safety and continuity of his operations, and to prevent damage to his installations, with specific emphasis on the overhead high-voltage electrification system. Except for necessary work in isolated spots, the railroad yard was declared "off limits" for the construction contractor.

In view of these restrictions, it became obvious that a conventional concrete deck should not be used, since the typical cycle of forming, pouring, stripping, and cleaning would involve more than ordinary hazard, which is synonymous with excessive cost. With the choice thus limited to prefabricated elements that could be quickly and safely erected, precast and prestressed slab units were adopted on the basis of comparative cost and availability.

Units designed were 22 ft long, 8 ft wide and 5½ in. thick. Slabs were set on 16-gage metal grout dams of swanneck shape, which were welded to the beam flanges. Non-shrink grout was placed between intermittent shims under the slabs, and retained by the grout dam. Slabs were fastened to floor beams by means of Nelson studs and steel clamps, forming a hold-down. Continuity of the slabs over the beam supports was effected by welding the mild steel top reinforcement across the supports. Grout was vibrated in the space between the slabs to bond the Nelson studs and top reinforcing. A topping of 2 in. of sheet asphalt was laid over the units as a wearing surface.

FIG. 2. Prestressed deck slab consists of individual panels 8 ft by 22 ft spanning between floor beams. This slab was used for four-lane continuous plate-girder bridge across yard of Pennsylvania Railroad Terminal in Manhattan. Photo shows completed structure.



Design was based on Westergaard's investigation of concentrated load effects on elastic slabs. To obtain proper distribution of wheel pressures and to avoid "free edges," the slabs were purposely made 22 ft wide, thus extending over the width of two lanes. Primary stresses in the slab, due to dead load and wheel concentrations, are resisted by a lateral compression prestressing force of 1,300,000 lb induced by 7-wire strands of 5/16-in. diameter, spaced 2 in. on centers. Mild steel reinforcing was used for crack prevention in a direction normal to that of the prestressing strands, and in the slab top. The prestressing made it possible to reduce the slab thickness well below that used in conventional design.

To study the behavior of these prestressed slabs and of the joints, under continuous pounding by heavy traffic, the Port Authority decided to perform exacting tests. For this work a special prestressing bench 20 x 24 ft was set up in the yard of Precrete, Inc. Two slabs were cast at a time.

In the first set, 146 strands of 5/16-in. diameter for each slab were stressed with a pull of 8,000 lb each. In the second set, 130 strands were stressed with a pull of 9,000 lb. Type III cement was used in the first pour and Type I in the second pour. The pull on each strand was kept below the 10,000 lb warranted by the elastic properties of the wire—to keep bond stresses low.

A test structure consisting of four panels was built within the area of the New York International Airport. Gasoline tank trucks running between a tank farm and fueling points were routed over this test structure. Drivers were instructed to go over the panels at the maximum possible acceleration. More than 10,000 heavy axles passed over the test structure at a speed estimated at more than 35 mph.

On completion of this test, pig iron was piled onto one of the slabs in such a manner that the bearing area of the pig iron covered roughly 60 percent of the span between the edges of the flanges. A device for measuring deflection was installed on the under side of the slab. When the design load equivalent of 42 tons was placed, no downward deflection was observed. This observation was in agreement with the engineer's prediction that the upward bow due to the prestressing would merely be flattened out by the application of the live load. Gradually the test load was increased to 200 tons, that is, approximately five times the design load equivalent. Slab deflection was observed to be 3/8 in.

Yielding of the supporting crib structure became noticeable, so no risks were taken in trying to observe cracks on the under side of the slab. However, when the test was discontinued, and the iron taken off the slab, there was no evidence of any cracks. On completion of the loading test, the asphalt topping was removed over the joints, and the grout placed between the slabs was chipped out. Inspection revealed that there were no apparent cracks in the grout, nor had any of the welds joining reinforcing bars been ruptured.

Design features of the prestressed deck slabs are illustrated in Fig. 2, and Fig. 3 shows the anticipated stress picture under maximum wheel concentrations. Design of the prestressing elements was based on the "Design Criteria for Prestressed Concrete, Bureau of Public Roads," for recommended working stresses, and reviewed for ultimate load.

Articulated precast deck panels

The master plan of the New Jersey approach called for the construction of additional traffic lanes on an existing steel structure 1,200 ft long, which extended from the westerly bottom slope of the Palisades to the marsh lands at the estuary of the Hackensack River in North Bergen County, known as "the Meadows." The structure, built twenty years ago, consists of two independent viaducts, each of which carried three traffic lanes in opposite directions. It was considered the lifeline of the Lincoln Tunnel, serving as a collecting feeder of arterial highways, including the New Jersey Turnpike.

Normally a heavily traveled road, it was distressingly congested at rush hours and on weekends.

Operationally, very little space on the existing viaducts could be spared to provide the necessary elbow room for the construction of the additional lanes. Forcefully impressed by this restriction, engineers again considered prefabricated units that could be quickly placed, thus easing the problem of the general contractor.

Straddling the gap between the two independent viaducts imposed a vexing engineering problem. Span lengths of the existing steel structures were about 150 ft, indicating a probable static deflection of 2 in. at midspan under full live load, and harmonic oscillations of unascertained frequency with corresponding amplitude. Since the traffic density of the opposing traffic streams was known to vary considerably, it was evident that each of the two viaducts would be vibrating at various time intervals, with a pronounced phase difference.

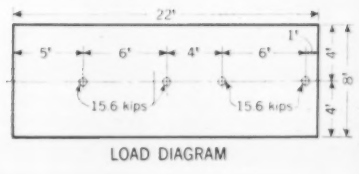
Translating this situation into design requirements, the structural elements bridging the gap would have to sustain stresses imposed not only by the normal loads but also by those caused by intermittent warping due to differential oscillation of the adjoining structures.

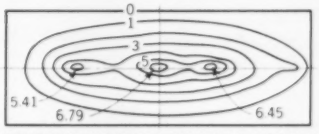
To meet these conditions, several alternates were studied. Cast-in-place concrete was eliminated from the range of possibilities, for the reasons stated above, and because there was doubt that it would provide sufficient strength under conditions of constant vibration. The second choice was a concrete-filled steel-grid floor, which would meet the engineering requirements. This was rejected for reasons of availability, high cost, and the necessity of painting an exposed steel soffit.

The construction finally adopted for bridging the gap is illustrated in Fig. 4. Precast concrete slabs 6 in. thick were prestressed in a direction normal to the flow of traffic and provided with cast-in-place continuous bearing plates, designed to rest on intermittent rockers welded to the framing below. This arrangement permitted freedom of end rotation by elimination of end restraints. Hold-downs to the steel supports consisted of structural bolts threaded into inserts in the bottom of the slab, arranged to fall between the rockers.

Slabs 10 ft wide were cast in lengths varying from 10 to 20 ft. Arrangement of prestressing cables and of supplemental mild steel was similar to that described for the Pennsylvania Yard bridge. When the units were delivered to the job site, they were laid on the supporting rockers, shimmed to meet existing grades, and clamped tight by inserting the hold-down bolts into the inserts. Longitudinal joints between adjoining slabs were sealed with concrete, which was locked securely into shear keys provided for that purpose. Traffic was fully maintained during the entire operation except for the temporary shutdown of a single lane.

Within the restrictions dictated by the general conditions of this project, prestress design successfully attained the limited objectives sought. The versatility of prestressed, precast units as demonstrated on the Lincoln Tunnel project, is distinctly encouraging. Bold and imaginative designs can be envisioned for the future in line with the potentialities of this promising technique.





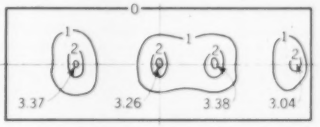
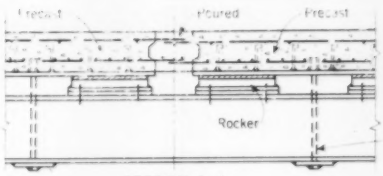
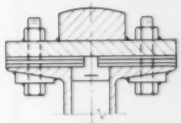


FIG. 3. Stress analysis is given for prestressed deck slab of Fig. 2. Figures in two lower graphs are in kip-feet per running foot of slab.





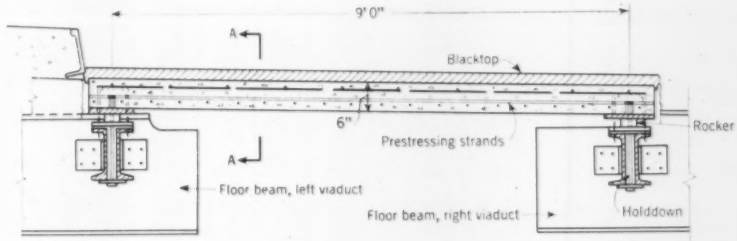


FIG. 4. Precast deck slabs prestressed in direction of traffic were used to bridge gap between two independent viaducts on New Jersey approach. Use of panels prestressed offsite avoided congestion in limited working space and enabled traffic to be maintained throughout, except briefly in one lane.

Supervision of design and construction for the entire Third-Tube Lincoln Tunnel Project was exercised by John M. Kyle, Jr., M.ASCE, Chief Engineer, The Port of New York Authority. R. F. Schaefer, M.ASCE, was Engineer of Design; Frederick C. Lowy, M.ASCE, Project Engineer for the design; and John S. Wilson, designer of the prestress elements.

(This article is based on the paper presented by Mr. Lowy at the ASCE Annual Convention in New York, before the joint session of the Construction, Highway, and Structural Divisions, presided over by E. S. Olcott, a member of the Highway Division's Committee on Session Programs, and Elmer Timby, Secretary of the Structural Division's Executive Committee.)

New, higher spillway was moved upstream from line of main dam, seen in background of view at near right. Black line and arrow indicate position of old spillway crest. New spillway appears merely as a low saddle in riprap cover from upstream side, middle view. From downstream side (far right), reinforced concrete of old spillway crest can be seen above crushed rock in process of placement. Although 6.5-ft level rod is at angle to camera, it gives some idea of rock size.

DOUGLAS W. BARR, A.M. ASCE

Consulting Hydraulic Engineer, Minneapolis, Minn.

R. W. ROSENE, J.M. ASCE

Chief Design Engineer, Rowat-Murray, Engineers, Belmond, Iowa

Loose-rock spillway

A spillway of loose dumped rock has greatly reduced the cost of enlarging the Municipal Reservoir at Osceola, Iowa. The designers are not aware of any similar use of loose rock for a spillway surface but expect it to withstand relatively high discharges without excessive displacement.

The spillway has a width of 100 to 124 ft and is designed to handle a flood of 2,700 cfs. The head across the dam, so far as this new spillway is concerned, is only 10 ft.

Osceola has had a reservoir at this location since 1935, but its storage capacity became insufficient to serve the needs of the growing community. To correct this situation, storage was increased from 340 to 1,400 acre-ft by raising the maximum water level 10 ft. Another increase in storage will be required in about 35 years, at which time the dam and spillway will again be redesigned.

The reservoir has a drainage area of about 10 sq miles, consisting of moderately hilly land with easily erodible soils. About two-thirds of the watershed is cultivated. The flood discharge of 100-year frequency is estimated at about 2,350 cfs. The design discharge is 2,700 cfs.

The spillway of the old dam consisted of a reinforced concrete apron about 8 in. thick perched on wooden piling driven to rock. The crest length was 124 ft. Along the crest line a row of steel sheetpiling was driven to rock about 35 ft below the crest. The old spillway had performed satisfactorily during the preceding 20 years and was in good condition. In raising the reservoir storage level, however, it was considered inadvisable merely to raise the crest of the old spillway because of the high shearing stresses that would be produced. Instead, a new spillway was constructed upstream of the old structure. Water discharging from the reservoir thus will pass first over the new spillway and then over the old spillway. The head across the composite spillway (the new and the old) is about 30 ft.

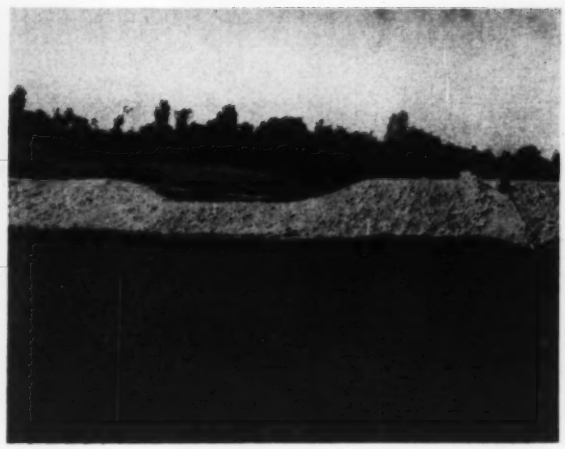
Since the nearest source of satisfactory concrete aggregate is 45 miles away, concrete construction would have been relatively costly. There is, however, a well developed limestone rock quarry within two miles from which rock of almost any size can be obtained. This rock is reasonably sound, although not acceptable for concrete aggregate. The soils available for use are very plastic, silty clays, notorious in the area for settlement problems. This factor would have added greatly to the cost and difficulty of providing a conventional concrete spillway.

The spillway design selected called for a deep bed of quarry-run limestone rock on a gravel mat, resting in turn on a rolled clay fill. At the crest line there is a timber bulkhead consisting of vertical piling and horizontal planking. The face of the spillway is on a 5 to 1 slope and consists of rock ranging up to 2.5 ft in average dimension.

Velocities of 17 fps are expected on the spillway during design flood flows. Computations indicate that rock of 2.5-ft nominal diameter will remain stable during such flows.

Rock size was controlled by varying the spacing and charge of quarry blasts. The available limestone rock broke into pieces of irregular shape, tending to be flat or platy. Quarry-run rock was selected not only because it was much cheaper but also because it was believed that the smaller particles in the quarry-run material would improve the stability so long as the matrix of the rock mass consisted of relatively large pieces. The specification for the quarry-run rock provided simply that 40 percent of the rock by weight should be 2 ft or more in major dimension. In addition, the intent was stated that the preponderance of the fill should consist of rock 2 ft to 3 ft in size. This specification worked satisfactorily, but it was found during construction that rocks of such irregular shape tended to have a "major dimension" considerably greater than their nominal size.

Undoubtedly some small rock will be washed off the surface of the spillway. Storage space to catch a reasonable amount of such displaced rock is available in the stilling basin between the new and the old spillways. Also some rearrangement of the larger rock will occur as the smaller rocks are washed away. It is expected, however, that the surface of the spillway will retain a



for low-head dam

cover of rock capable of withstanding the tractive force of flood flows.

In the absence of any experience with this type of spillway or of model tests applying specifically to it, the timber bulkhead was incorporated into the structure to insure that the crest would be maintained even though a considerable amount of rock should be displaced. With scour below the crest and filling of the stilling basin between the new and the old spillways, the slope of the spillway surface would be greatly reduced. So long as the crest remains intact, a reduction in the tractive force of the water must follow, as well as an increase in the critical tractive force of the rock, thereby providing a large safety factor.

The new spillway has a flat crest 100 ft long and sloping crests on each end making a total crest length of 124 ft, the same as the old spillway. The spillway required about 4,100 tons of rock contracted at a unit price of $2.70 per ton. The total cost of the spillway itself, including the timber bulkhead, was $16,000. The spillway will pass 2,700 cfs with a water level in the reservoir about 4.0 ft above crest elevation. Estimates for a conventional concrete spillway of equivalent capacity ranged from $50,000 to $100,000.

The use of this type of spillway would appear to offer possibilities for great economy on low-head dams where rock is readily available. As research continues to expand our knowledge of sediment transportation, it is possible to design with increased confidence in the stability of loose dumped rock.

Engineering for this project was handled by Rowat-Murray, engineers, Belmond, Iowa, and Douglas W. Barr, consulting hydraulic engineer, Minneapolis, Minn. The contractor was the C. and C. Construction Co., Martinsdale, Iowa. Resident inspection was provided by Dale Gracey and Warren McCormick, Osceola, Iowa.

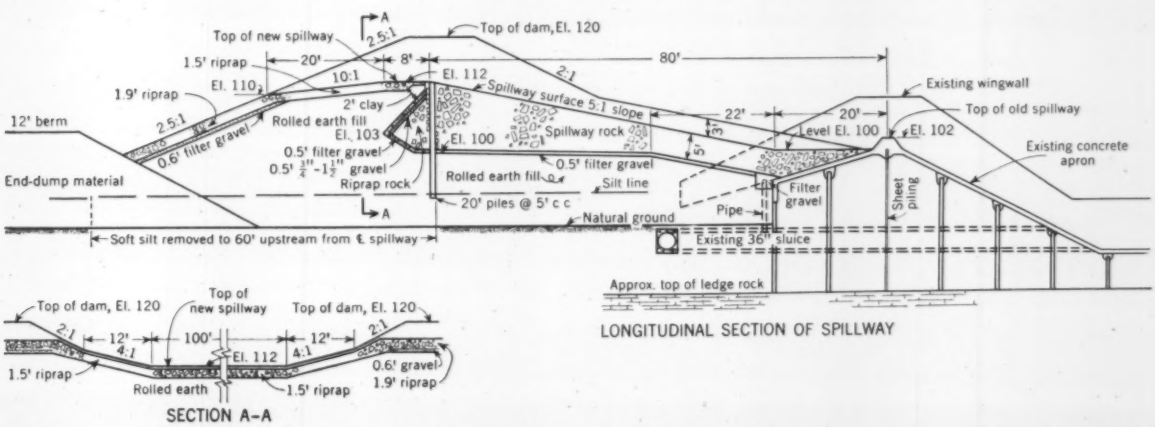
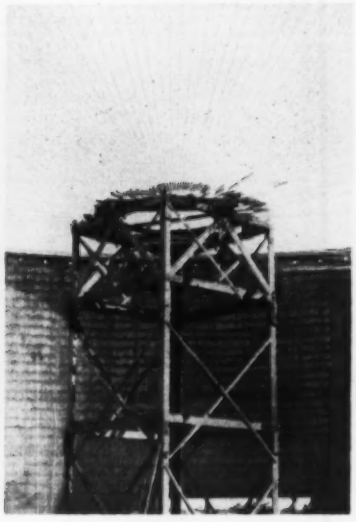


FIG. 1. Spillway designed for discharge of 2,700 cfs consists of loose dumped rock. Lack of experience with this type prompted installation of creosoted timber bulkhead to insure maintenance of crest height.



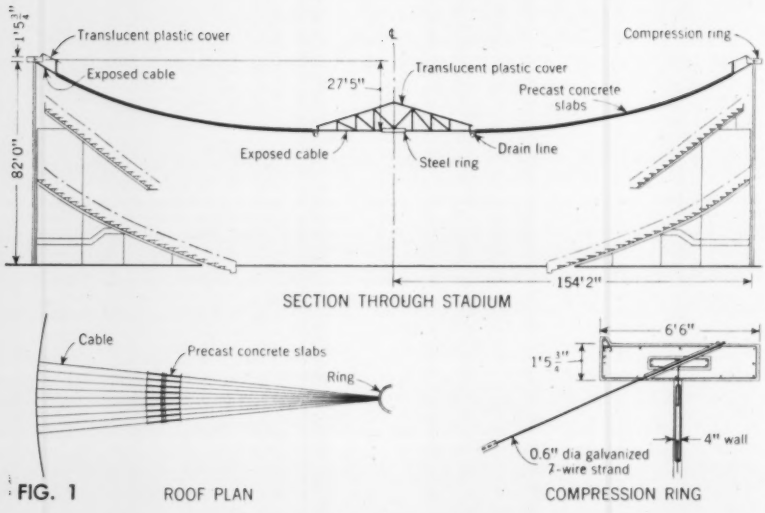
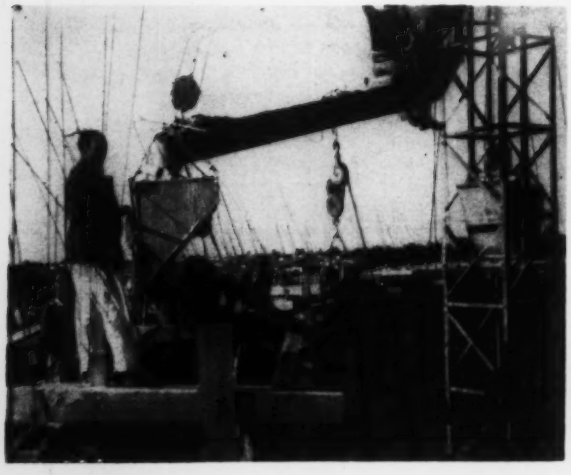
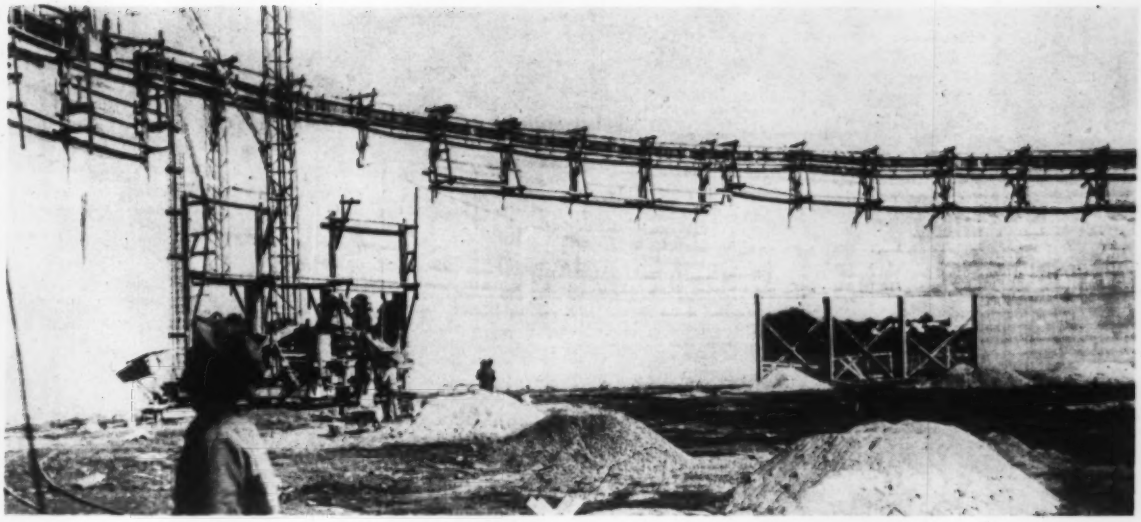


FIG. 1

Montevideo, Uruguay, has new 20,000-seat stadium. Circular wall has diameter of 310 ft and height of 85 ft. It was raised in 2-ft 4-in. lifts by a slip-form method, with concrete mixing and placing equipment running on circular track inside wall. See views below and on facing page. Only scaffolding used for the roof was that which held center steel tension ring (view directly above) until cables were hung between it and outer compression ring extending around top of wall.





Cable-supported roof cuts cost

M. SCHUPACK, A.M. ASCE, Vice President and Chief Engineer, The Preload Company, Inc., New York, N. Y.

A unique roof design and unusual construction methods cut the cost of a 20,000-seat stadium recently completed for the city of Montevideo, Uruguay, to one-third that of the nearest competitive design. The novel roof was conceived by L. A. Mondino, L. I. Viera, and A. S. Miller of Montevideo, with The Preload Co. Inc., as special consultant on the design of the prestressed roof system. This embodies a concave surface and requires no columns, buttressing or construction forms. It was constructed by the firm of Mondino Y Viera Ltda.

This stadium project was initiated by the City of Montevideo, which asked for competitive bids for the design and construction of a structure meeting the following requirements:

"A permanent structure shall be designed and constructed to suit the requirements of boxing matches, basketball, tennis, ice hockey, etc., to take place either day or night. The first stage of construction does not require more than the roof and its supporting elements. The diameter of the arena shall not be less than 135 ft and the spectator capacity shall not be less than 20,000. Solutions necessitating intermediate supports or pillars will not be acceptable. The time permitted for completion of the work included in the first stage shall be 14 calendar months."

The adopted design (Fig. 1) is cylindrical in shape, has a diameter of 310 ft, and an exterior wall 85 ft high. The suspended roof is supported on 256 Roebling cables anchored at their outer ends to a compression-ring cornice which tops the cylindrical wall, and at their inner ends to a steel ring at the center of the stadium. The roof itself is of precast concrete slabs 2 in. thick.

The cylindrical shell, without stiffeners or buttresses, is of reinforced concrete 4 in. thick, requisite strength and stiffness being inherent in the curved shape. A familiar example indicating the strength of such cylindrical shapes is that of the common tin can, which easily supports the weight of a man. This shell supports the 850-ton roof load and resists the wind forces.

To support the wall, 64 pairs of cast-in-place concrete piles (Viermond) were placed on 15-ft centers. The wall itself was constructed by a modified slip-form method, framework and scaffolding being raised 2 ft 4 in. each day, support being provided by that part of the wall previously completed. Reinforcing steel was placed after the forms were lifted to each new position. A total of 36 lifts were made in completing the job. Concrete was hoisted to the forms by a rail-mounted derrick which traveled from position to position on a circular track inside the cylinder. High-early-strength cement was used and both external and internal vibrators were employed to insure uniform strength of concrete. At 14 days the cylinder strength of the concrete averaged 5,600 psi. Eight doors, each 44 ft 7 in. wide by 16 ft 5 in. high, are uniformly spaced in the cylinder wall.

Along the top of the wall runs a reinforced concrete compression ring, 6 ft 6 in. wide and 1 ft 5¾ in. thick. Roof-supporting cable strands are anchored to this compression ring and extend radially inward to the 18-ft-diameter center steel ring, to which they are bolted. This ring is composed

of two parallel component rings each 2 in. thick and 12 in. wide, which are held apart by spacers and welded at the inner edges to a common hoop-like anchorage plate. Each strand passes between the two component rings, through holes in the continuous anchor plate, and is held in place with a nut on its threaded anchorage. The seven-wire, galvanized strands, of 0.6-in. diameter, terminate in swedged Roebling threaded anchorages at both ends. Besides acting as anchors, the threaded ends also facilitate adjusting the drape of the strands. While the strands were being connected, the 50-ton tension ring was supported on scaffolding 53½ ft high—the only scaffolding used for the erection of the roof. The 18-ft-diameter ring was fabricated in the United States and shipped to Montevideo in one piece.

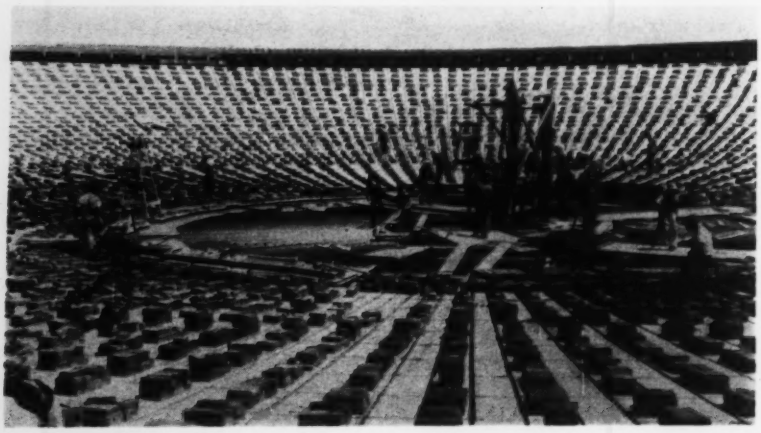
Next, some 9,000 prefabricated slabs were attached to the strands and to each other working outward from the inner circle of 65-ft diameter. They are trapezoidal in shape, 2 in. thick and 3 ft 3 in. long, and their widths vary with their position on the roof. The reinforcing bars project from the four sides. Those which extend laterally form hooks which loop over the cables and support the slab. Slabs were not installed right up to the tension ring. Rather, an open circle was left around this ring with its outer diameter 65 ft 7½ in. This opening is covered by a wire-glass cone-shaped skylight which is supported on a conical steel space-frame. A skylight opening also was left around the periphery of the roof. Both skylights are supported on the cables.

To prevent cracking of the roof due to stretching of cables in service, the 850-ton roof was prestressed. This was done by placing bricks on the slabs to provide a 50-percent temporary overload, causing the cables to stretch. While the load was in place, openings between slabs and around the cables were filled with mortar retained by asbestos cement form-boards wired into place under each joint. These were left in place. After the fill mortar hardened, the brick overload was removed. This prestressed the inverted dome radially and increased the monolithic quality of the shell part of the roof. Skylights then were installed and waterproofing applied.

Drainage from the dished roof flows to a collecting trough around the center skylight and is carried through four pipes of 12-in. diameter, hung under the ceiling on a 1½-percent slope, to wall downspouts and to the storm sewer. Montevideo is an area of very low annual rainfall and no snow.

In all, only 40 days were required to complete this roof. The schedule was as follows:

Raising and positioning central ring, 1 day
Connecting the 256 cables, 6 days
Setting the 9,000 slabs, 17 days
Placing the overload of bricks, 10 days
Filling between the slabs, 1 day (21 hours)
Unloading the overload, 5 days



Precast roof slabs were hung on cables (above). Bricks were then placed on slabs (below) to overload concave roof structure. After joints between slabs and around cables had been filled with mortar, bricks were removed, thus prestressing the slab.

The surface of the roof actually forms the line of force of the dead weight, exerting only tension. Horizontal components are absorbed by the compression ring, and the vertical components are transmitted to the walls and piling and thence to the ground.

The proportions of a structure of this type are governed more by practical sizes than by theoretical structural needs. The sag detemination is limited by the practical requirement that the slope at the outer part of the concave surface must be such as to permit placement of the precast panels. In general, a sag of 1/10 to 1/12 the diameter seems to satisfy this condition.

For this particular structure, where seismic shock is not a problem, the roof shell is supported so that it allows free breathing under temperature changes or live loading. The desired condition was obtained by an unbonded 9-ft length of cable at the outer ring. As in any detailing of strands or cables, it is always necessary to avoid bending of wire around sharp corners. To avoid this where the strand projects from concrete or steel enclosures, lead tape was wrapped around the strands to assure formation of a bell-mouth exit.

Cost of this stadium without seats was $644,000. A design utilizing a structural-steel frame sheathed in aluminum was bid at $1,900,000, and one with a thin-shell reinforced-concrete dome, at $2,400,000.

Exposure for 5 sec at f 11 with Royal Pan film gave this night concreting picture of Long Sault Dam on the St. Lawrence.

AL MELLETT, Chief Photographer for Uhl, Hall & Rich, Engineers for the Power Authority of the State of New York, Massena, N. Y.

CONSTRUCTION PHOTOGRAPHY on St. Lawrence Power Project

The St. Lawrence Power Project covers an extensive range of construction methods and features. The Power Authority of the State of New York wisely decided to cover this epic of engineering in color, black and white, and motion pictures. The photographic equipment, methods and procedures which are employed should be of interest to engineers, contractors, equipment manufacturers, and photographers.

Few engineers and contractors realize the importance and value of construction photography. As a means of communicating ideas, photography has no equal. America's remarkable construction progress has been made possible only by pooling knowledge and experience and by continually improving and expanding the methods employed.

Photographs are too often made in a haphazard manner through indifference or fear of the cost. Construction photography can pay off and here's how:

1. The cost of photography for an entire project can sometimes be offset by one set of photographs in the case of a claim.

2. Photographs for the press and technical journals can stimulate good will and provide advertising for owners, engineers or contractors.

3. Accident photographs are obviously a must.

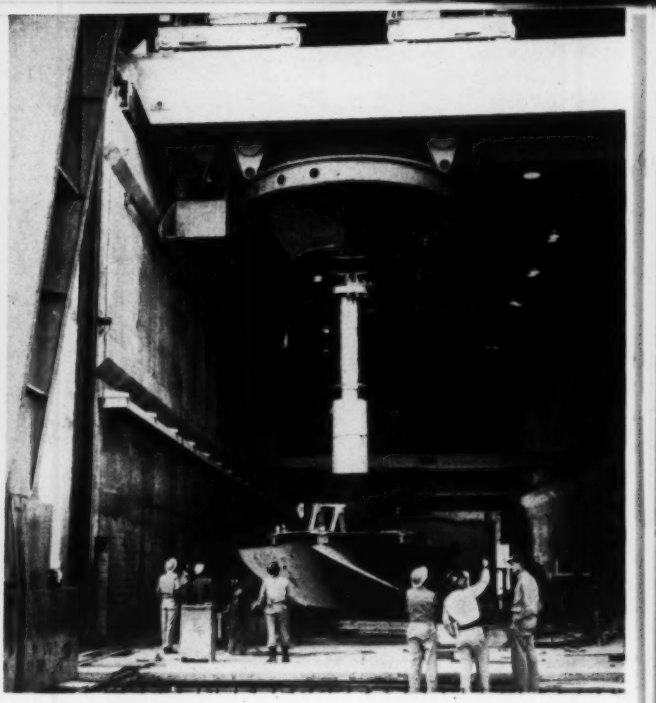
4. Photography is the only method of accurately recording conditions which later may be changed or obliterated such as structures that are to be razed or property that is to be developed.

5. Most details of construction are buried in concrete, earth or water. A photographic record reproduces conditions during the various phases of the work.

6. Technical articles are dull and ineffective without illustrations.

7. Photographs of construction methods may be used for reference and

A K-2 filter with 1/200-sec exposure at f 20 on Royal Pan film gave this February construction picture of the Power Dam. Heated concrete, steam piped to all areas, and protective covers permitted concreting through the winter.



Fast Royal Pan film made it possible to take this shot with available light only, using a Speed Graphic at 1/50 sec and f 16. An intermediate headcover is shown being lowered over a turbine runner.

instruction when similar problems arise elsewhere.

8. Progress photographs will tell the complete story of the project.

9. Human interest pictures are always acceptable to newspapers and company magazines.

On large projects, one or more resident photographers are a must. When an outside professional photographer is given a contract to take progress photographs periodically, good print qualilty is assured but the photographer is not always on hand when important events are happening. He also does not understand the job and, except for overall views, must frequently be taken by the hand to insure coverage of basic construction details and progress. A resident photographer lives with the job, understands his construction project, and plans and anticipates his pictures during various stages of the work. On many jobs of average or small size, the photographs can be taken by engineers or inspectors if they follow a few basic principles.

A good photographer on a construction job should fulfill three requirements:

1. He should know his photographic materials and equipment and should strive for technically perfect prints.

2. The pictures should have good composition—should retain the interest of the viewer. Distracting details and poor composition defeat the purpose of the photo, which is to put an idea across to others whether it be for advertising purposes, to show in court, or to tell a story of progress. But the two foregoing requirements are not enough.

3. The photograph must tell a story. Each picture should be taken with a purpose. Can a good caption be written for it? Are the men in sight concentrating on one main activity?

It is not enough to have complete photographic coverage—quality must be maintained and the pictures should meet certain requirements:

1. They should be always sharp and clear. Fine detail can be achieved by proper exposure, correct focus, and a steady camera. Camera movement is probably the greatest offender, and accounts for the many fuzzy pictures seen in construction magazines. If hand held, the camera should be placed firmly against the face or body and elbows should be held tight against the sides. Fast films will permit the use of high shutter speeds to cancel movement and small apertures for greater depth of field. A tripod is the best assurance of sharp pictures and will permit ground-glass composing and greater depth of field.

2. The subject should be clear and uncluttered. One central feature should be evident in each photo.

3. Action should be shown by including equipment and people at work. Be sure that some ham is not posing or looking at the lens. We automatically destroy such negatives.

4. Include a familiar object for scale, such as a pencil or rule for a close-up of aggregate, or people standing near out-size equipment.

5. Lighting is important. If possible, wait for the proper time of day. Cross lighting will give roundness to curves and bring out texture in surfaces. Front lighting or reflections will penetrate shadows. Sunlight striking at an angle of 45 deg usually gives good results.

6. Use a flash for most close-ups, especially in bright sunlight.

Cameras should be carefully chosen. Press cameras will probably give the best results, and when used with wide-angle and telephoto lenses can cover nearly any condition. The negatives make excellent enlargements. They should be operated by experienced photographers. Press cameras are sometimes too bulky under certain conditions such as climbing. Reflex cameras using 120 film are excellent for ordinary use even by unskilled photographers. We have distributed about a dozen such cameras to field offices for record photography and find them well worth their cost.

Although 35-mm cameras are economical in operation, we employ them only for taking color transparencies. Unless care is used, from exposure to processing, 35-mm black and white shots tend to be grainy and unsharp when greatly enlarged. As construction photographs require sharpness of detail, larger negatives are used. But color

Air views generally were made with a K-20 aerial camera using Tri-X film and a "minus blue" filter. This December 1957 shot of the St. Lawrence Power Dam was exposed 1/500 sec at f 6.3. The cofferdam will be removed this spring. Power production is scheduled for fall.

transparencies are invaluable for showing to groups.

The faster films such as Tri-X or Royal Pan will permit the camera to stop the action of construction, provide a good depth of field and allow high shutter speeds for hand-held shots. With proper exposure and processing, grain will not be objectionable even in extreme blow-ups. In the case of color transparencies, we have found that Kodachrome combined with a warm or skylight filter gives the best color reproduction although it is slower than other color films. The warm filter will counteract the excessive blue in distant or aerial shots or in shadow areas.

For extensive operations such as on the St. Lawrence Power Project, aerial photography is required to tell the complete story. This is not as expensive as it would seem. A Piper Cub is excellent for good visibility, slow speed, and maneuverability and can be rented for $12 to $15 per hour with pilot. Our black and white shots are taken with a war surplus K-20 aerial camera or with a Speed Graphic. Color slides are taken with a Leica or other good 35-mm camera with interchangeable lenses.

With panchromatic film, a medium yellow filter will give the correct color rendition in gray tones while a red or orange filter will give more dramatic effects. Remember that a filter will lighten the color tones similar to the filter color and darken complementary colors. A red filter will show red objects as white and blue objects as black. Color film for artificial light can be used in daylight with the proper filter.

Processing of pictures should be done in close cooperation with the photographer or by the photographer. On a large project, it will pay to set up a photo lab. On smaller jobs, an agreement for film processing should be made with a local commercial photographer. In either case, the darkroom technician should collaborate with the photographer, advising of over or under exposure, focus, or other problems.

Negatives should be edited, then identified. On the St. Lawrence Power Project, we have many features ranging from powerhouse construction to construction of public beaches. Each negative is assigned a number chronologically and a letter for identification with its feature. The negative is filed in an individual envelope, by serial number. Contact prints are made and mounted in albums with proper identification.

In addition to still photographs, motion pictures can be taken and shown to the public, to schools, and to contractors' and engineers' groups—a very effective medium for creating good will. Our footage covers the progress of the project, including interesting features of engineering and construction. From time to time, footage selected from our files is made into sound pictures to explain the project. Such films are shown to interested groups and on TV.

A tripod with a built-in level can make the difference between professional and amateur results. We use 16-mm color film, and, of course, it is taken at 24 frames per sec for adaptation to sound. Aerial shots are made at faster speeds to slow down the motion of the plane. Work prints are made for editing and viewing purposes. The original footage is stored in a vault and is never projected.

Photography is expensive but is a sound investment. Much of the expense is due to the time required to take a picture. When a particular action is to be recorded, it always seems that the equipment breaks down, it starts to rain, or the men go to lunch. When a resident photographer encounters such conditions, he can usually find other profitable shots to take in the vicinity because of his familiarity with the project.

To make photographs pay off, they should be sent to the owner, who can then see how his money is being spent. Designers can see how their work is being carried out. The contractor's home office can keep a check on safety, housekeeping, and progress. Public relations benefits greatly by good pictures. The local press always wants news stories, and if proper illustrations are available, will keep the public informed of progress rather than of construction annoyances. Technical journals always welcome illustrated articles on unusual equipment or methods. Well-illustrated methods, whether new or proven, help construction novices and give refresher courses to the experienced.

Each picture should be accompanied by a caption. We copy the typed captions and print them below the photograph. Another method is to affix the typed caption below the photograph with rubber cement. The print should not be marred with paper clips or hard pencil on the back.

Plan your photographic coverage and reap its benefits.

Shutterbugs: CIVIL ENGINEERING will be pleased to have detail and action pictures from your engineering job or office. Do not send negatives. We want sharp glossy photos, with a caption telling the reason for the picture and briefly describing the job. Name the engineer, the contractor, and the equipment used on the job.

Improving secondary-school teaching

Among many serious problems that lie ahead in education not the least is the training of young men and women in science and engineering. This problem is further aggravated by the fact that with the increasing numbers of students, not enough well-trained teachers will be available even to maintain today's educational standards. Secondary schools face an even more critical shortage of able teachers of science than colleges and universities, and since student numbers are much greater, the consequences of inadequate teaching may be more disastrous.

A second problem, always associated with large numbers of students, is to maintain quality of instruction. One consequence of our determination to see that opportunities for college education are provided for all may be the untoward development of curricula which offer little challenge to superior minds. Superior minds are a most precious resource of any country that expects to assume or hold leadership in the modern world. It is as important to develop our superior intellectual resources as to develop our uranium ores.

Larger values may be overlooked

Another problem is the ever-present danger of imbalance in educational programs because of pressures to promote special interests or objectives. Unless care is exercised, educational programs can become seriously distorted, so that technical training will replace education as a major responsibility of our institutions of higher learning.

So much attention is being given to the practical achievement of science in promoting comfort in daily living, in controlling disease, and in developing nuclear energy, rockets and space travel, that there is danger of overlooking several equally significant virtues of science instruction—teaching the student to realize the importance of examining all evidence impartially, to keep his mind open to all ideas, to understand how knowledge is acquired, to vigorously sift all evidence from which conclusions are drawn. In brief, such instruction should enable the student to recognize and value those qualities of mind and spirit that underlie all real achievement in the sciences.

Adequate preparation for college

Colleges and universities are not happy about the inadequate preparation of entering students. Perhaps some criticism is warranted, but it is kept in proper perspective by the fact that during the first forty years of the twentieth century an almost explosive expansion of secondary school education occurred. At the close of the nineteenth century only about 8 percent of the 14- to 17-year age group was enrolled in the high schools. Today more than 80 percent of this age group is entering the secondary schools.

Professional scientists are increasingly aware of their responsibility to see that the subject matter taught in secondary schools is modern in concept and adequate in scope. As a case in point, I have been told that only recently have changes been made in either the course content or the instructional procedures in mathematics as taught for the past hundred years in the nation's elementary and secondary schools.

Students' attitudes toward mathematics are often established in elementary school. Frequently these attitudes are unfavorable, often antagonistic, even fearful. We are slowly becoming aware of the importance of a careful study of the psychology of learning and of the necessity of cooperative approaches to early instruction in mathematics, which bring to focus on this problem the wisdom and experience of both our ablest mathematicians and our most competent psychologists and educators. The study of mathematics should be an inspiring experience for young and eager minds. In fact it may do more to expand the latent resources of the mind than many other subjects. Here then is a need for a study that is long overdue and which may, if properly done, alter the whole aspect of the mental landscape so far as science and engineering are concerned.

Foundation's many-sided program

Now let me turn to some ways in which the National Science Foundation contributes to improve science instruction in secondary schools.

Visiting Scientists Program. Supported by grants from the Foundation, the professional scientific societies of the mathematicians, chemists, biologists, and physicists have selected distinguished scientists to visit small colleges and high schools for periods of several days. The scientists conduct seminars, hold conferences with interested students and staff members, teach classes, and give public lectures. These visits have proved to be highly successful in interesting students in science and in increasing the effectiveness of science instruction.

Traveling Science Demonstration Lectures. High school science teachers selected for exceptional competence are given three months of training at the Oak Ridge Institute of Nuclear Studies in preparing a series of lectures and demonstration equipment. The teachers then visit high schools in all parts

DONALD B. ANDERSON
Program Director for Education in the Sciences, National Science Foundation, Washington, D. C.

in science and mathematics

of the country presenting the lectures, on such subjects as atomic structure, nuclear energy, electricity and magnetism, and space travel. Lectures are conducted in such a way as to encourage student participation through questions and discussion. This program has been popular and effective, not only in interesting students but in assisting science teachers in the use of simple apparatus to demonstrate basic principles.

Curricular Studies. The Foundation has given substantial support to efforts of distinguished scientists and experienced educators to reexamine the content of science courses of secondary schools. One group, working in the field of physics, has brought together the ablest talent of three of our distinguished universities and experienced and competent high school teachers to prepare a more effective course for high school students. The study may well involve writing texts and laboratory manuals, preparation of a series of instructional films, and a more modern approach to fundamental concepts.

Summer Institute Programs. Perhaps the Foundations's most important single program for improving science teaching has been the Summer Institutes. Science courses especially designed for high school science teachers are given during a 6- or 8-week period on the campuses of colleges and universities. Science teachers receive compensation for themselves and their dependents and free tuition. The Foundation supported 96 summer institutes in the summer of 1957, at which more than 4,500 high school teachers of science received instruction.

Academic-Year Institutes. Opportunities are also provided for high school science teachers to receive instruction in the sciences during the academic year on the campuses of colleges and universities. At present, there are two of these special series of courses. Next year there will be 16 in various parts of the country. Teachers receive a stipend of $3,000 in travel and dependency allowance, as well as free tuition. They register for special courses in the sciences designed to increase their understanding of the subject matter in fields in which they will teach.

In addition, the Foundation supports shorter conferences and meetings which bring together scientists and high school teachers to examine recent developments in science or secondary-school science courses. Frequently such conferences include school administrators, college teachers, and representatives of state education departments.

In another effort to arouse the interest of high school students in science and engineering, the Foundation gives support to the Science Clubs of America, a program administered by Science Service Incorporated. In these clubs, more than 300,000 high school boys and girls participate in projects such as science fairs, held every year in all parts of the nation.

Supported by a grant from the Foundation, mathematicians of one of our major universities have been making a study of the intermediate school textbooks of mathematics used in Russia and Poland, to make known to our teachers any new and original methods of teaching or subject matter that may be helpful in our own high schools.

These are some of the channels through which the National Science Foundation is working to increase the competence and effectiveness of high school science teaching and to arouse the interest of high school students in science. Industry, private foundations, and other agencies have also given generous support to similar activities.

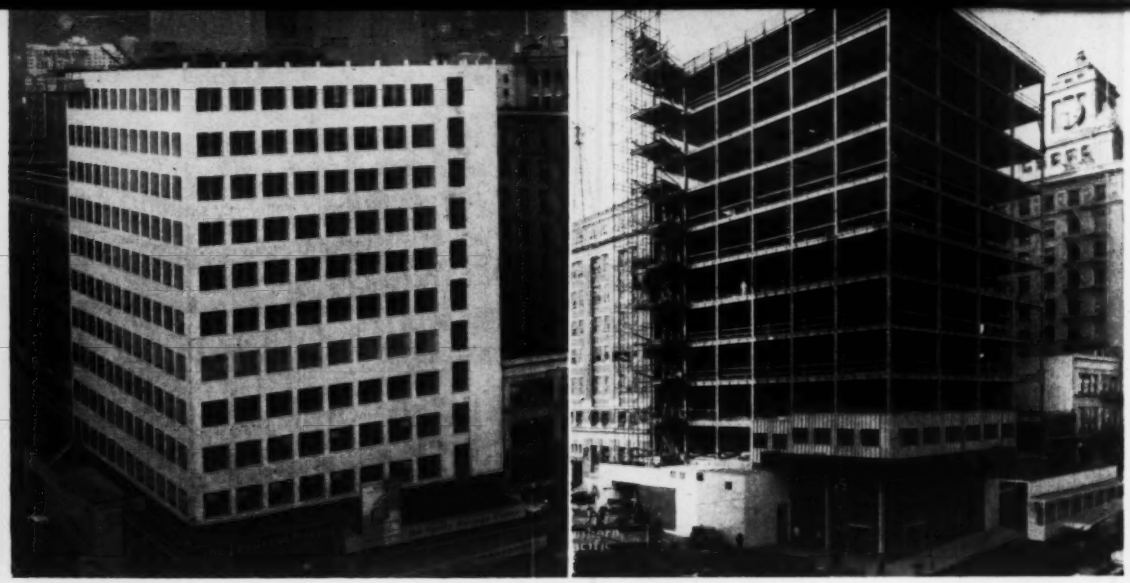
Scientists too feel responsibility

One very encouraging aspect illuminates the otherwise rather dark picture of high school teaching: many distinguished scientists and engineers are actively interested in the problems of secondary school education and are accepting responsibility for contributing to the improvement of this situation. This is a welcome change from the ivory-tower aloofness which characterized so many scientists a few years ago. Now they are willing to take time from research problems of absorbing interest to work with experienced educators in seeking solutions to current problems.

I can think of no more appropriate way to close these comments than to quote from Alfred North Whitehead's essay, "The Aims of Education":

"In the conditions of modern life the rule is absolute, the race which does not value trained intelligence is doomed. Not all your heroism, not all your social charms, not all your wit, not all your victories on land or at sea can move back the finger of fate. Today we maintain ourselves. Tomorrow science will have moved forward yet one more step and there will be no appeal from the judgment which will then be pronounced on the uneducated."

(This article is taken from Mr. Anderson's paper presented at the ASCE Jackson Convention, in the panel sponsored by the Committee on Engineering Education, at the Department of Conditions of Practice session presided over by Department Chairman Glenn W. Holcomb, with Elmer K. Timby as moderator.)



Structural steel for 10 stories rises above operating savings bank on retained first floor of old concrete building. Cellular steel floors on steel framing permitted rapid erection.

ROWLAND S. ROSÉ Partner, Cooper & Rosé & Associates, Portland, Ore.

Direct-to-steel fireproofing for Portland

An existing five-story concrete-frame building in Portland, Ore., was recently converted to an 11-story steel-frame structure while the owner continued full operation of a savings and loan business on the first floor. The $2 million Executive Building, 100 by 100 ft in plan, has direct-to-steel fireproofing that saved enough vertical space to permit an extra story in the same overall height. The building has a structural steel weight of 8 lb per sq ft, about two-thirds the usual weight for a building of this type.

The extra story was gained by spraying vermiculite acoustical plastic fireproofing directly onto the under side of the cellular steel floors. This also eliminated fire dampers and permitted using the space between the finished ceiling and the floor above as a plenum for the air-conditioning system, as well as to conceal duct work and utilities.

Construction is of special interest. The old building was demolished from the second-floor level and the new steel-frame structure erected on the stumps of the original columns at that level. The existing five-story building was reinforced concrete and L-shaped in plan, with an interior court above the first floor. It was originally designed to carry six stories. Column spacing was 16 ft in the north and south direction and 19 ft east and west.

The owner, Pacific First Federal Savings & Loan Association, wanted a modern office building with rentable space above the second floor. There would have been no room for air-conditioning ducts, however, had the total structure been retained. A study disclosed that it would be more economical to demolish to the second-floor line and erect a new building on top of that over the entire site, than to have just an L-shaped, marginal building.

Lightweight steel framing, cellular steel floors topped with lightweight concrete, and lightweight fireproofing permitted a maximum number of stories to be added without increasing the soil pressure on the existing footings.

The steel framing was designed on a semi-continuous basis, conforming to AISC Report No. 206, and was connected with high-tensile-strength bolts. The relatively close column spacing established by the original concrete design, and the use of semi-continuity in designing floor support members, developed about 47 percent of full continuity and saved about 7 percent in structural steel weight.

New steel columns were welded at the second-floor level to steel base plates welded to the top of the reinforcing steel of the old concrete columns, which were cut off at this point. From that point erection proceeded in normal fashion. In the court area, the existing one-story building was demolished and new footings and steel columns were placed to carry the structure.

The building is designed for seismic loading, with lateral load distributed to bearing walls around stairs and elevators and property line walls, all of which are of reinforced concrete. This was another aid in reducing the amount of structural steel required. The columns and beams were fireproofed with lightweight plaster applied over metal lath.

The cellular steel floors consist of 3-in. units fabricated by the Detroit Steel Products Division of Fenestra, Inc. They were placed flat side down and topped with 2½ in. of lightweight concrete. Then a 1-in. thickness of vermiculite acoustical plastic was sprayed by machine on the under side in three coats. This direct-to-steel method resulted in space savings of 12 to 15 in. per floor.

The finished ceiling is perforated metal pan. Acoustical pads were omitted at points where air is let through from the plenum space above. Lighting fixtures are surface-mounted.

The top three floors of this concrete frame building were removed and replaced by 10 stories of steel frame structure.

building

Typical height of the finished ceiling is 9 ft.

For the first story, the floor-to-floor height is 18 ft 8 in.; for the other stories it is 12 ft 4 in. Overall height is 144 ft plus a 25-ft penthouse over two-thirds of the roof area. This contains the air-conditioning equipment. The structure is completely air-conditioned on a zone basis.

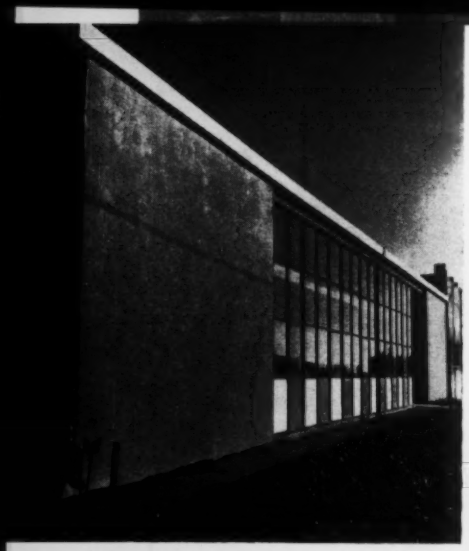
The building was finished as a loft, and space is finished off as leases are obtained. There has been no difficulty in dividing up rental areas despite the unusual column spacing. Partitions are steel stud and lightweight plaster, except for the permanent partitions, which are plastered concrete block. Services are concentrated in a core located at one side of the structure.

Exterior of the building is faced with marble. Fenestration is fixed plate-glass set in aluminum sash. An interior fire tower was installed to avoid marring the appearance of the structure with an outside fire-escape.

Cost was about $18.00 per sq ft.

Architects for the project were Stanton, Boles, Maguire and Church; structural engineers were Cooper & Rosé & Associates. General contractor was Hoffman Construction Co., and the fireproofing was applied by Billings & Cronn, plastering contractor. All the firms are in Portland, Ore.

Direct-to-steel fireproofing for Executive Building in Portland, Ore., saved enough space to provide an extra story in same overall height. Beam fireproofing is here being sprayed on. Vermiculite acoustical plastic is machine-applied directly to cellular steel floor.



Wide variety of window and wall treatment is possible with this type of construction, including glass-panel walls. Window boxes and door canopy below were added after erection.

RALPH STONE, M. ASCE

Ralph Stone and Company, Consulting Engineers, Beverly Hills, Calif.

Concrete tilt-up construction

Tilt-up construction utilizes a prepoured concrete building floor as the casting area on which the wall panels and, if desired, even a reinforced concrete roof can be poured and then lifted into place.

Improvement in the quality of the construction materials and also reduction in the cost of building fabrication remains a continuing challenge. Currently large numbers of concrete tilt-up buildings are being constructed in California and other areas. The basic reason for this popularity is the economy that can be realized by this method, particularly on structures of over 10,000 sq ft in floor plan, as compared with buildings of brick, masonry and other conventional materials. See the accompanying table.

Concrete tilt-up construction is particularly applicable to square or rectangular buildings, in which use of the floor for modular precasting of the wall panels is simplified. Wall panels are normally lifted from the floor by large motor cranes, and poured concrete is generally employed to tie the reinforcing steel of the walls, floor, and foundations together. A diaphragm roof gives further structural support.

In addition to low construction costs, the tilt-up method provides such further advantages as rapidity of construction, a minimum of hand or craft labor, and a minimum of forming. It also results in the use of building materials of high quality, namely concrete and steel. Commonly panel members can be cast and lifted into place within 14 days.

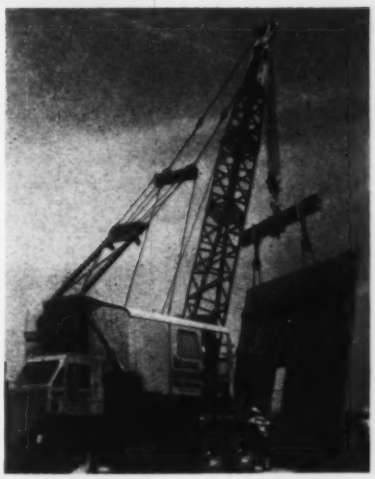
The simplicity of the construction procedure makes for clean appearing buildings. Architectural ingenuity can assure the construction of outstanding structures. Various panel treatments can be employed to provide surface textures and architectural variety on the tilt-up walls. Scribing, window boxes, special aggregates, canopies, and other appurtenances can be used to beautify exteriors.

Most of today's concrete tilt-up buildings are one-story structures designed for warehousing, manufacturing, and offices. Two-story and a few three-story structures have been successfully designed and built. In the future, possible applications of this construction method to both larger and smaller private and commercial structures will pose a challenge to the design engineer. The need for large motorized cranes to lift heavy wall panels into place is being met by the equipment manufacturers. It appears that increased construction productivity will be achieved by an even greater use of mechanized fabrication techniques, which can be advantageously linked with the tilt-up method.

A typical cost breakdown for a concrete tilt-up building is given in the table. Future application of prestressing and thin-shell concrete design may result in even further cost reductions by cutting the amounts of steel and concrete required.

Tilt-up wall panels are cast directly on prepared building floor, below. In slabs at right, steel windows and roof joist straps were set in slab before casting. If preferred, window frames can be set after wall erection.

for savings



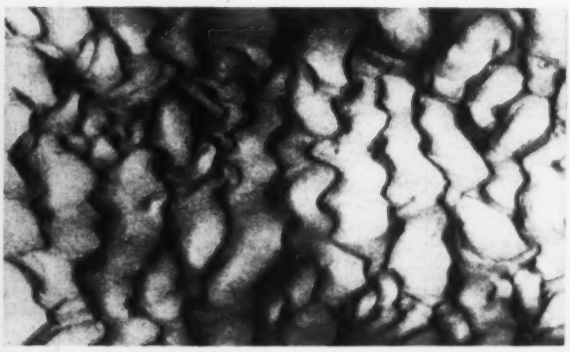
Smaller panels are lifted with two pick-up ropes attached to anchors cast in slab. For larger panels, more pick-up anchors may be required.

Costs for a representative concrete tilt-up building

One-story structure built in Los Angeles, Calif., in June 1957 has 20,000-sq ft floor plan—17,000 sq ft of warehouse and 3,000 sq ft of office space.

Item	Dollars per sq ft
Preliminary work and excavation	$ 0.06
Concrete foundation and flat concrete	0.37
Tilt-up and columns	0.75
Reinforcing steel and mesh	0.28
Rough lumber and labor	0.47
Finish lumber: sash, doors, labor	0.02
Wood trusses	0.19
Fire doors	0.06
Structural steel and misc. iron	0.07
Roof	0.13
Sheet metal and skylights	0.04
Stainless letters	0.02
Masonry	0.04
Overhead doors	0.05
Finish hardware	0.01
Electrical	0.08
Painting	0.05
Clean-up	0.01
Plumbing	0.09
Offices	0.30
Contingencies	0.30
Total	$ 3.39

Roof trusses or girders are set on pilasters and columns cast in place between slabs. Roof diaphragm commonly consists of 1 X 6 boards or ⅜-in. plywood sheathing.



Study of subaqueous dunes in 60-ft flume at California Institute of Technology is supported by National Science Foundation grant. Dune formation is seen above in close-up.

NSF promotes

Most engineers in this country would be surprised and somewhat taken aback if they were told that they as a group had been negligent in promoting their share of basic research. Civil engineers, especially, might argue that the nation which built Hoover Dam, the San Francisco Bay Bridge, the Empire State Building and many other "engineering wonders of the world" certainly could not be negligent in research. But it is true there has been apathy toward basic research, not only in civil engineering but in all engineering and even in some areas of the pure sciences, including physics and chemistry. This is stated with full cognizance of the fine work done in civil engineering research by some universities, the Bureau of Reclamation, the National Bureau of Standards and similar agencies. This situation is especially critical in the engineering fields since physics and chemistry have almost deserted those classical fields on which engineers are dependent as a foundation for their development and design work.

Basic research is one index of a nation's scientific progress. Yet this nation has been largely dependent upon research in Europe. Although, in the long run, basic research pays off in the most practical terms, nevertheless, direct and immediate links between it and its applications are extremely rare. Therefore federal assistance appears necessary to assure its continuous support. Congress took some remedial action in 1950, by creating the National Science Foundation. For the first time in our history a special agency was established to encourage and stimulate basic research and education in the sciences.

The powers and responsibilities assigned to the Foundation by the Congress are, in part: "To develop and encourage the pursuit of a National policy for the promotion of basic research and education in the sciences; to initiate and support basic scientific research in the mathematical, physical, medical, biological, *engineering* and other sciences . . . ; to award . . . scholarships and graduate fellowships in . . . the sciences and to foster the interchange of scientific information among scientists in the United States and foreign countries; to evaluate scientific information among scientists in the United States and foreign countries; to evaluate scientific research programs undertaken by individuals and by public and private research groups; to maintain a register of scientific and technical personnel and in other ways to create a central clearing house for information covering all scientific and technical personnel in the United States. . . ."

It has been the experience of the Foundation staff that engineers are relatively uninformed as to the activities of the Foundation despite its potential importance to them. This article attempts to remedy this situation.

NSF is limited by law to the support of "basic research," but there exists some confusion, especially on the part of engineers, as to just what this means. The picture is often distorted by the popular press, which is likely to ignore the fundamental work on which new developments are based. The problem of "basicness" is doubly difficult in the engineering fields since most people, including many engineers, think of the engineering sciences as being wholly within the applied region. The difficulty is that the transition from basic research to development is a smooth one with no well-defined dividing line. In fact, the interests of engineers vary in a continuous spectrum from the engineering scientist-researcher to the design engineer. NSF is concerned with the scientific end of the spectrum.

Philosophically, basic research may

GENE M. NORDBY, A.M. ASCE, and ROBERT N. FAIMAN

Respectively Program Director and Engineer, Program for Engineering Sciences, The National Science Foundation, Washington, D. C.

basic research in civil engineering

be defined as a quest for knowledge with intellectual curiosity as the only motivation. But a program cannot be administered on this basis; some ground rules must be established, and each research proposal submitted to NSF is considered individually. Research in the engineering sciences does not necessarily follow the usual classification of aeronautical, chemical, civil, electrical or mechanical engineering, but rather is described by areas of mutual interest such as fluid mechanics, properties of materials, and thermodynamics. Also, in considering whether a particular project is "basic," the criteria of time and economics may be applied as a guide. If a problem is required to meet a deadline with a usable and economic result, it probably is not a basic study. Basic research should advance a field of knowledge and deal with new principles but emphasis should not be placed on the development of an economically feasible process, device, or product. In summary, basic research in engineering may be defined as that which has the widest application.

Federal agencies, and private industry, because of their need to reach a precise objective in a limited time, usually concentrate their support on those scientists who have already achieved a reputation. NSF, on the other hand, in the interest of developing scientists, *may* support the young untried scientist to develop him to a point where he will be of more value to the nation, although the excellence of the research proposed is always a primary consideration. Thus, without the renewing functions of the Foundation, the supply of men and ideas for applied research may dry up.

Major funds to universities

Most engineering scientists at present are associated with educational institutions, and basic research enjoys a high status in universities. Therefore a major share of the Foundation's funds has gone to these institutions either directly in support of research projects or indirectly through fellowships. An extremely valuable by-product of the Research Grant Program is its educational function in the training of young research assistants under the guidance of experienced investigators.

The money required by NSF has not been accurately determined. The annual budget has risen to 40 million dollars a year for all its activities. Expenditures in the engineering sciences have risen from $42,000 in 1952 to $1,367,350 (exclusive of fellowships) in the fiscal year ending June 30, 1957. Already the impact of its program can be felt in research throughout the nation.

To give a better perspective on the type of project supported and the scope of its activities in civil engineering, several typical grants will be summarized.

Typical of several soil mechanics studies is that of Prof. A. R. Jumikis, M. ASCE, at Rutgers University, on the "Migration of Soil Moisture Under Freezing Conditions." He has been making a quantitative investigation of the upward movement of water in soil when freezing surface temperatures cause the formation of ice lenses in the soil. It was necessary to build a laboratory instrument to measure the upward migration of the soil moisture, and the experimental results have been thoroughly buttressed by theoretical analysis. Some of these results have already been presented at meetings of the Highway Research Board.

At Lehigh University, Prof. Lynn Beedle, A.M. ASCE, has contributed materially to plastic design theory. NSF cooperated with the Column Research Council, U. S. Bureau of Public Roads, and the Pennsylvania Highway

Thermistors to be embedded in a soil sample are checked by Professor Jumikis in his studies of freezing and thawing processes in soils at Rutgers University, sponsored by NSF.

Department in the support of his work. NSF funds were used to investigate "The Influence of Residual Stress on Column Strength," an examination of the effect of residual cooling stresses and cold-bending stresses on both wide-flange rolled and built-up columns. Residual stresses as high as 42,000 psi have been measured in the course of the experiments.

In the past it has been customary to compute the strength of metal columns on the basis of stress-strain curves determined from coupons cut from the cross-section. In cutting these coupons, however, the residual stresses have been substantially changed so that the necessary relationship between the coupon and the column has omitted the influence of residual stress. It is hoped that the inclusion of the residual-stress idea will lead to a column formula built on a scientific rather than an empirical basis and, in turn, to better design practice.

Professors Vito Vanoni, M. ASCE, and Norman Brooks, J.M. ASCE, at the California Institute of Technology, recently completed a study of the "Mechanics of Sub-Aqueous Dunes." They were concerned with the effect of these dunes on the roughness, velocity, and sediment transporting capacity of a stream. A laboratory flume was constructed and motion pictures were taken at high speed to resolve the motion of individual sand grains, and other motion pictures, with time delays, to speed up the motion of the dune pattern. An understanding of dunes will be of importance in the control of natural waterways.

Effluents from nuclear operations have peculiar and unfamiliar waste characteristics. How these wastes affect sludge digestion has been the subject of much speculation. It is possible to remove toxicity, to stabilize organic matter, to oxidize cyanides, or to reduce or kill bacterial populations; however, time alone will reduce the rate at which radioactive materials give off their energetic and damaging radiations. For his pioneering work in this field, at Georgia Institute of Technology, Dr. Werner Grune, A.M. ASCE, and his assistants, James V. Carter, Jr., and J. Peter Keenan, were awarded the Harrison Prescott Eddy Medal in August 1957 by the Federation of Sewage and Industrial Wastes Associations.

It will be noted that these research projects satisfy the criteria for basic research in the engineering sciences in that they are not directly of an applied nature and may be considered largely independent of both time and economics. Such research is of critical importance to the future of engineering in the United States, since the increasing rate of development of both military and commercial products is eating deeply into the backlog of such fundamental knowledge, upon which most successful development work rests. The engineering profession in the United States has been second to none in the application of scientific knowledge to practical problems, but has produced little fundamental knowledge of the "break-through" kind.

The fundamental instrument which the Engineering Sciences Program employs is the research proposal. A scientist initiates a research project by proposing a specific area of study, and includes a brief history of the topic of study, the proposed experimental work, a budget, bibliography, and the biography of the investigator. The budget may contain contributions to the investigator's salary, the salaries of graduate assistants, equipment, travel, and other items.

When received at the Foundation, the proposal is reviewed by a number of engineering specialists in the field of interest involved, under what is known as the "referee" system. Their rating is based on the qualifications of the applicant, the character of the research environment provided by the institution, and the subject of the proposal.

In the past five years, over 600 reviewers in the engineering sciences field have contributed their services in evaluating proposals for the Program for Engineering Sciences. In addition, the Program has the advice of the Advisory Panel for Engineering Sciences, a group of distinguished engineering scientists selected from all fields of engineering.

A proposal that has been evaluated favorably by reviewers is submitted to the National Science Board for approval, and if funds are available, a grant may be made. Thus in large measure the Program is directed by the profession itself.

Grants are simple and flexible. In a sense they are gifts, and consequently a minimum of reports and detailed information is requested from the grantee. The Foundation does request a semi-annual financial statement and copies of any publications resulting from the grant. A final detailed report is not required, but the principal inves-

tigator is encouraged to publish in existing journals since it is in the national interest that all results of basic research be published promptly.

There are no rigid deadlines, nor is there any pressure to produce a specific result or to solve a particular problem. The grants are intended to ease the path of the researcher, to enchance his teaching abilities, and to fit smoothly into academic life.

Grants for equipment are not considered separately, but may be encouraged as a part of all research proposals. The Foundation's responsibility for encouragement of research sometimes results in the "seeding" of a new activity at an institution that has competent investigators but lacks the necessary equipment to actively examine an area. Equipment purchased through the grant becomes the property of the institution.

In seeking research support, the first and most important step is the conception of the fundamental idea. Usually this idea is something of special interest to the investigator, to which he has given considerable thought or on which he has already done some work. Many times these ideas are generated by the "feedback" process, that is, an interesting phenomenon is discovered in the course of a practical problem.

Other activities included in the Engineering Sciences Program are the support of conferences for dissemination of scientific information and travel grants for attendance at international meetings.

Engineers recognize the value of small conferences dealing with subjects of limited scope where discussions are extensive. As a rule, the subjects discussed are on the frontiers of knowledge where ideas are in a state of flux and where the sharing of ideas is most beneficial. Such a meeting was held at Fontana Village, Tenn., sponsored by the ASCE, NSF and the University of Tennessee on the "Mechanics of Sediment Transport." Although research in this field has been active since the early 1930's and before, this conference is believed to have provided the first opportunity for outstanding workers in the field to examine collectively, in an atmosphere of objective analysis, the needs of practicing engineers and the contributions of research. Participants were mostly civil engineers, but also in attendance were chemical engineers, geologists, and agriculturalists. Support of a conference usually originates with a group of scientists doing active research in the field or with a society or institution concerned with the problem.

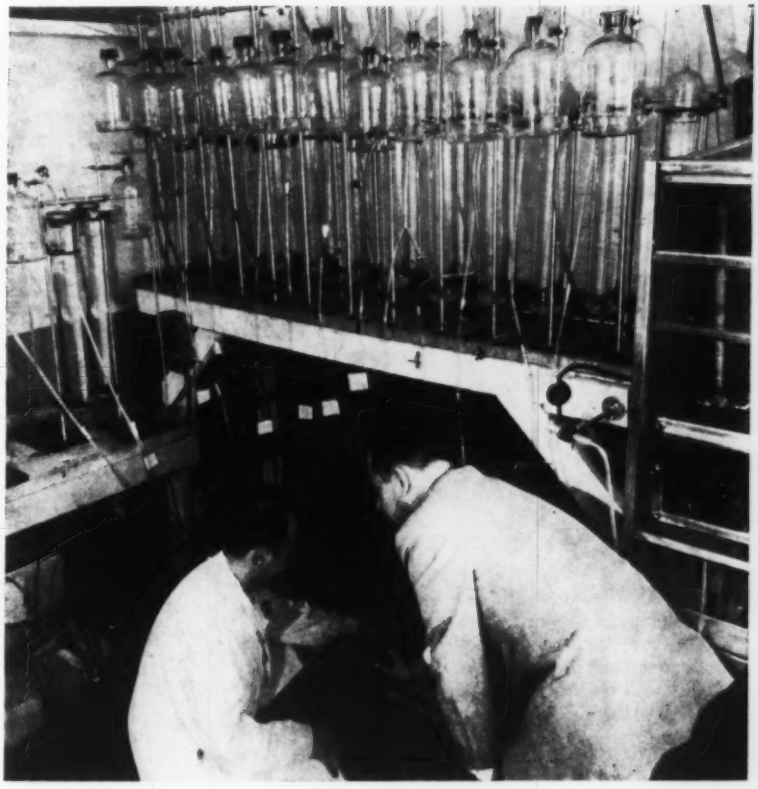
Meetings of an international nature are also supported if held in the United States. NSF contributed to "The World Conference on Earthquake Engineering" in 1955, the "International Conference on Irrigation and Drainage" in 1957, and the "World Conference on Prestressed Concrete" in 1957. Support is usually for travel expenses for foreign speakers, simultaneous translation services, or publication of proceedings.

Foreign meetings are supported by travel grants to participants from this country, the aid usually consisting of round-trip tourist air fare to the place of meeting.

Besides research grants, the Foundation has already made various facilities grants. Support of the radio astronomy facility in Green Bank, W. Va., the reactor facility at Massachusetts Institute of Technology, and computer facilities at various universities are examples. The Engineering Sciences Program is now studying the major facilities needed for basic research in engineering schools throughout the country. Preliminary estimates show this need to be extensive—amounting to several hundred million dollars. The Foundation is trying to establish the extent of governmental responsibility in supplying these needs, but faces a difficult problem where the need is immediate and extremely large. Allocation of funds—sometimes millions of dollars—requires considerable planning and may take two to three years.

One of the problems connected with these large facilities is the continuing cost of operation and maintenance after they are established. Continuing federal support threatens an indefinite financial burden, a claim against future appropriations, and a degree of control over science that the Foundation does not seek. The American Society for Engineering Education is currently making a more detailed study of these needs in engineering through an NSF grant, and is preparing a detailed report for the guidance of the profession.

Detailed procedures for securing NSF grants may be found in the booklet, "Grants for Scientific Research" prepared by the Foundation and available from the Program Director for Engineering Sciences, National Science Foundation, Washington 25, D. C. Further details on the Foundation's activities can also be obtained from this source.



Experiments with high-level radioactive waste are in progress at Georgia Tech under NSF grant. Professor Grune, right, and Roy Peek, graduate student, measure gas production of digesters behind lead brick wall.

PIPELINING is engineered design, construction, maintenance and operation

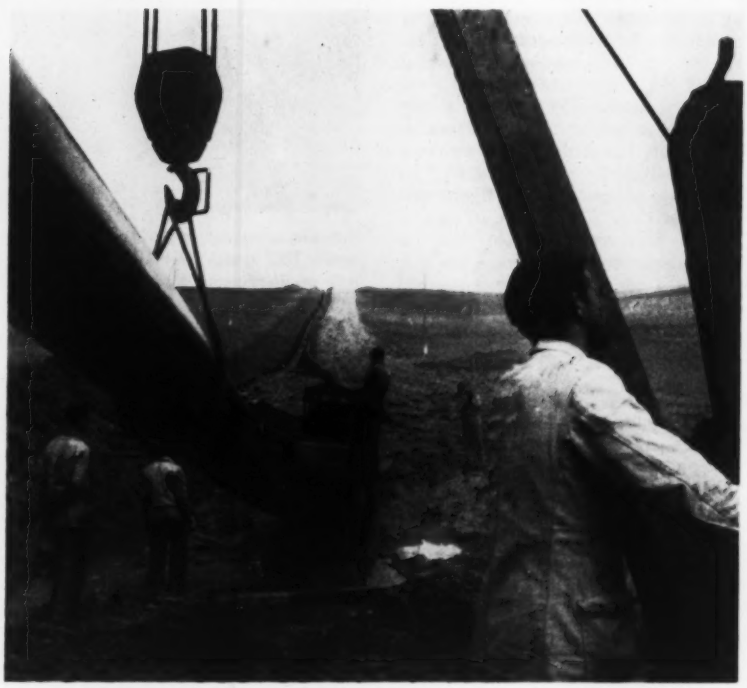
L. B. COMBS, M. ASCE, Rear Admiral, CEC USN (Ret.)
Head, Department of Civil Engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

One of the fastest growing transportation mediums in the world—and certainly the longest in point of mileage—is the pressure-operated, metal pipeline. It is uniquely a product of American ingenuity and engineering in planning, design, construction and operation. It is a part of yesterday's history, today's economy, and tomorrow's news.

Of course pipes and piping systems of various types and materials have been devised and used since ancient times, generally for transporting water. Today in addition to water, pipelines carry cargoes of gas, crude oil and steam, refined products, and now solid materials in limited amounts.

Perhaps the transportation of natural gas by pipeline began at Fredonia, N.Y., in 1821. Undoubtedly the news that natural gas had been burned, and subsequently piped, to light the town of Fredonia was just about as spectacular and eerie to the folks of 1821 as was the news of the first atomic explosion to the folks of 1945. It is a tremendous leap from that zero year to the estimated total of nearly 500,000 miles of the gas pipelines which today supply over 25 million homes, thousands of industries, and one quarter of the nation's energy requirements. Likewise, the completion of Van Syckle's 6 miles of screwed-joint crude-oil pipeline, the first successful one with pumping facilities, probably amazed the people of 1865 as much as the completion and operation of our "Big-Inch" and "Little Big-Inch" lines amazed the public during the years of World War II.

Much scientific and engineering knowledge was available a century ago, but builders didn't always use it. In 1874, the so-called Columbia Conduit Line from Millerstown, in Butler County, Pa., to Clairview near Pittsburgh, was laid on the surface in hot summer weather. When winter came, the line contracted violently, most of its joints pulled apart, and it was a total loss. Another venture, the first line across the Allegheny Mountains, was laid in winter on the surface. When summer came the reverse happened and the line twisted all over the place and split wide open. Experience is sometimes a harsh teacher but her lessons are the ones we don't forget.



Fuel pipeline built by Bureau of Yards and Docks for Spanish Air and Naval Bases is being cleaned and primed.

Transportation by pipeline, it is predicted, will develop to handle many materials other than fluids, but so far pipelines carry primarily crude oil, refined products, and natural gas. The tremendous growth of these industries has accounted for most of our pipelines, particularly the cross-country trunk lines. Only pipelines can tap new and remote oil and gas fields and link them with refineries and thence with markets. These products, their gath-

ering, storage and distribution, are becoming synonymous with national development and even national survival. As more sources have been discovered and the demand for these products has grown, larger and longer pipelines have been built. They have become competitive with other transportation mediums.

At first oil lines were constantly threatened; many were torn up by the teamsters, who had held the monopoly on haulage. In 1879 the Big Benson Pipeline, a 6-incher running over the Alleghenys, marked an epoch in pipeline installation. The railroads began to realize that pipelines were real competitors and they began to put obstacles in their way. Pipeline construction had to overcome many man-made hazards. But the public was beginning to recognize that pipelines were efficient and economical carriers, and our free competitive system stimulated their progress. Soon, everyone realized that each system of transportation complemented the other and that all had to move forward together to meet the needs of a rapidly expanding economy. It is rather paradoxical that during recent years one railroad company, the Southern Pacific, has completed an 844-mile products line along its own right-of-way between Los Angeles and El Paso. Several other railroad companies are considering the feasibility of similar lines both for refined and crude products. This is a very significant and favorable development for pipelining.

Another forward step in engineered pipelining occurred in 1891 when S. R. Dresser developed his flexible leakproof joint. This marked the real beginning of large capacity and relatively high pressure in natural-gas pipelines. When acetylene welding came into use in the late twenties, it displaced the Dresser coupling to a considerable extent on cross-country lines, but this coupling has continued in use on many distribution lines.

Still another forward step was taken about 1926, when successful large-scale production methods were developed for the manufacture of seamless pipe. The making of seamless tubing was started over a century ago in England. Mannesmann patented his machine for making it in Germany in 1885, but it was not until 1926-1928 that seamless pipe production began to get into high gear in the United States. By 1928 the electric arc began to displace gas welding. Steady improvement in the electric-arc welding process in radiographic and radioactive methods of inspection, and in mechanical facilities, have of course been major contributing factors in making pipeline design and construction the efficient arts they are today. With the advent of seamless pipe and electric welding, screw joints and lap welds could be eliminated. The development of higher strength steels permitted more economical pipe thicknesses while providing adequately for the variable and high pressures used. Thus the electrical engineer, the mechanical engineer, the metallurgist, and the steel manufacturer were making major contributions to pipeline engineering.

One of the most interesting examples of the value of fundamental scientific principles and experimentation in this business is the multiple products line. Two scientists named Poiseuille (1842) and Darcy (1857) probably laid the foundation for the hydraulic formulas that are used today but perhaps the success of the products line is mostly due to the experiments of a college physicist, Osborne Reynolds, who in 1883 proved the principles of streamline and turbulent flow and developed certain formulas to analyze them. In 1893 a multi-products line was built from a refinery in Oil City, Pa., to Wilkes-Barre, N. Y. Wiseacres jeered as they always do, but it was successful. The mixing of the various products at contact points in the pipe was limited to a maximum of about 50 ft, although it is doubtful if the builders and operators knew just why at that time.

In 1914 Stanton and Parnell experimentally confirmed Reynold's theories as a criterion for fluid flow. Shortly thereafter, they were proved mathematically by Buckingham of the Bureau of Standards. Many subsequent experiments have continued to verify and develop the application of Reynold's theories to the design and operation of products pipeline systems. Product lines also have required the development of new and intricate pumping equipment, terminal facilities, and dispatching methods. Luckily for most consumers, the proved effectiveness of multiple-product lines is more easily seen than explained. The operator who knows the characteristics of his line can, with the aid of mathematical charts and radioactive isotopes inserted in the line at the point where the product is changed, predetermine and execute his operations with uncanny accuracy and efficiency. The very latest systems are applying "automation." The new 500-mile multiple-product line (12-in., 10-in., 8-in.) for the Spanish Air and Naval Base program is a good example of one of the latest engineering developments in this category.

The automatic operation of oil pipelines and refineries, and particularly of gas and products lines, seems to be an early objective. Some engineers believe that automation in this field is still in the future but numerous companies are rapidly installing such equipment.

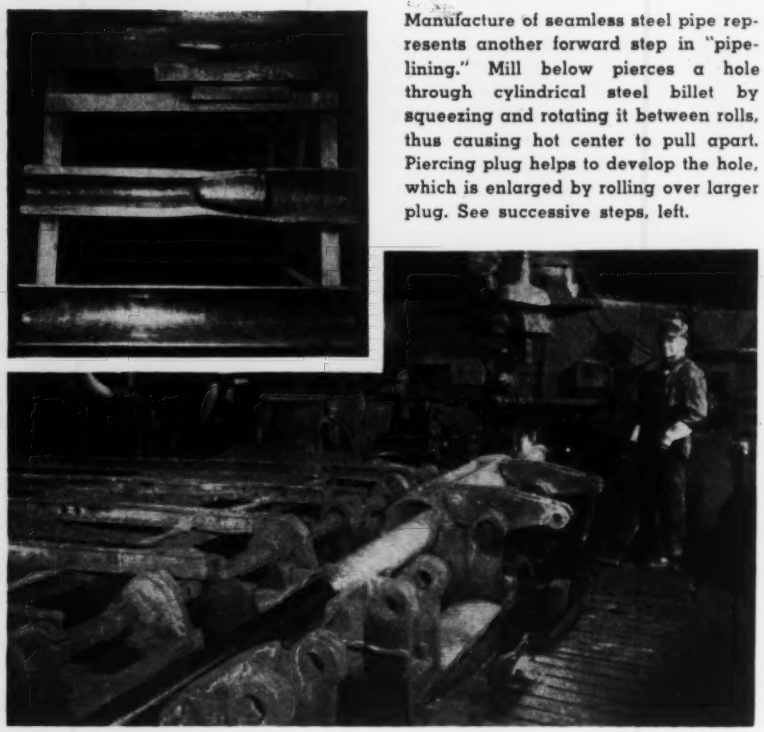
The basic divisions of automation have been characterized by J. Fred Ebdon, editor of *Gas*, in the January 1958 issue of that publication (p. 94), as follows:

1. **Sensing elements**—instruments that sense given conditions and/or measure variables
2. **Data converters**—devices that change analogue information to discreet digital values, or vice versa
3. **Recording devices**—instruments to write down conditions and values of variables sensed
4. **Communications links**—media for transmitting data that bind automatic elements into a system
5. **Logic devices**—the controllers and computers that monitor conditions of the variables calculated as required, and initiate action steps that will result in a change to given conditions of a variable or variables
6. **Actuating mechanisms**—the "muscle" units that actually move, reset, start and stop, adjust, etc., the prime physical components of the gas and product systems.

Three new techniques which perhaps are proving the most promising keys to automation are automatic data logging, electronic computers, and stream analyzers. Also, the use of positive displacement meters and a new type of fast sensitive recorder gravitometer have been most successful. The installation of such equipment may not always reduce the number of employees but it will definitely increase efficiency and thus reduce costs.

Actually, complete automation is not something that can be accomplished within a short time. Such planning involves a gradual changeover from manual to semiautomatic, to remote-setting automatic, and finally to full automation. There must be computers with accessory equipment at the power sources at the compressor stations and a general pipeline computer to make the major decisions and transmit the orders necessary for efficient, safe and economical flow programming. One very important factor in full automation is the completion and accurate transmission of orders and communications. All this is, of course, a very expensive installation but it is believed that it will eventually be standard procedure.

The initial success in the design and operation of product lines would seem to foretell eventual success in the transportation by pipeline of many materials other than fluids. Many of our engineering design solutions today, in all fields, seem fantastic when compared



Manufacture of seamless steel pipe represents another forward step in "pipelining." Mill below pierces a hole through cylindrical steel billet by squeezing and rotating it between rolls, thus causing hot center to pull apart. Piercing plug helps to develop the hole, which is enlarged by rolling over larger plug. See successive steps, left.

with the way we were doing things 25 years ago. In 1944, C. E. Wuensch made some studies for a complete pipeline transportation system to handle ore. As an interesting sidelight, the analysis indicated that, on a comparative theoretical basis, a pipeline could handle aggregate material cheaper than did the Kaiser Company's 9½-mile belt conveyor used at Shasta Dam.

The Pittsburgh Consolidated Coal Co. proved in 1951 that coal slurry could be successfully transported through a short 12-in. pipeline. This company has now completed a 108-mile line for transporting such slurry from its mines in Ohio to a power plant in Cleveland. Several years ago ore and tailings were handled successfully by the Nickle Co. of Canada through a 7½-mile pipeline. A new 8-in. line about 100 miles long is now being laid by the American Gilsonite Co. in the State of Utah to handle gilsonite ore slurry. Paper pulp is being successfully handled through 10-in. lines about 2 miles long in Ontario, Canada.

Naturally there are many skeptics, but in the light of scientific and engineering progress during the past 25 years, is it too optimistic to predict that we will be transporting at least some of our aggregates, our cement and other building materials, as well as grain and foodstuffs by means of pipelines within the next 25 years?

Another very interesting technical development is the application of what is called "cathodic protection" to underground metal structures of all types. Present methods of cleaning, wrapping, and testing new pipelines have all combined to greatly reduce if not to prevent exterior corrosion and thus to permit the use of thinner pipe of greater diameter for high pressures.

Probably the principle of applied reversed electro-chemical current flow, or "cathodic protection," has its greatest application to pipelines in city and urban areas where stray currents are many and complex. An intensive study and application of such protection to old pipe systems probably would add many years of useful life to such systems. It has even been suggested that pipe wall material might be added in bad spots. The study, design, and installation of such protection are highly specialized, but cathodic protection is both feasible and economical. Numerous engineering organizations are successfully applying it.

Aerial photography and photogrammetric methods for mapping, estimating and locating pipelines are now the rule rather than the exception. The sequence of operations from conception to completion of a new pipeline project was comprehensively covered by Stephen A. Bechtel, Jr., in his article "Civil Engineering in Pipelining" (CIVIL ENGINEERING, June 1956, p. 61). This illustrated the major roll civil engineers play in "pipelining."

Pipelines have become ambassadors for better relations with foreign peoples. The 1,100-mile Trans-Arabian system is a fine example of a great pipeline engineering feat of modern times but it also is a contribution to easier, happier living for the neighboring Bedouins. The water supply provided for the pipeline construction project, essential of course, but incidental to the main project, has practically revolutionized the life of these desert people. They just didn't have water before.

Modern writers frequently use the expression "pipelines have come of age." It would certainly seem that since 1880 pipelines and the pipeline industry have been growing steadily, with a good prospect of continued growth.

In 1880 there were 700 miles of pipelines.

In 1900 there were 18,000 miles.

In 1918 (at the end of World War I) there were 55,000 miles.

In 1928 there were 102,000 miles.

Between 1928 and 1932 the mileage was increased to 116,000.

Note the considerable mileage of pipelines installed during the depression years of 1929-1931.

It is significant that today, about 26 years after the depression period of the early 30's, we have in the United States and Canada a pipeline network in all categories totaling over 700,000 miles. To this of course could be added a very considerable mileage in other countries throughout the world.

The biggest year on record for pipeline construction in the United States and Canada was 1957. In that year about 15,400 miles of natural gas lines, 4,800 miles of crude oil lines, and 2,900 miles of product lines were constructed. On the basis of past experience, it is estimated that in 1958 at least 23,000 miles of new lines will be constructed in the United States and Canada and 3,700 miles in foreign lands.

About 65 percent of the energy requirements of this country are now furnished by oil and natural gas. Pipeline facilities handle most of this. There are very few of our industrial establishments that do not draw from pipelines in some manner. What will be the impact of the so-called Atomic Age on the pipeline industry? The impact should be good and stimulating for business. Some are concerned for fear there will be a drop in the demand for carbon fuels but it seems to be the considered opinion of most competent authorities that nuclear-generated power will not supplant any of the power

now generated from coal, oil or gas; rather that the ever increasing demand will require the full use of all.

If the demand for electric power is a good barometer of economic and industrial growth, and many think it is, then it is an encouraging sign that the capacity and consumption of 116 million kw in 1955 increased to an estimated consumption of 150 million kw in 1958 and will become 350 million kw in 1970. These figures portray the need for a great expansion of all generating sources. In addition to industrial and commercial consumers, gas now goes directly to an estimated 26,000,000 home customers in 43 states and it is estimated that this number will increase by one million each year for the next three years and reach over 40 million by 1975.

Many major pipeline projects are in prospect. Among the larger ones for 1958 are the Beatrice Project planned by the Natural Gas Pipeline Co. of America and the Colorado Interstate Gas Co. This will require the laying of more than 1,000 miles of pipe, mostly 30-in. and 36-in., between Oklahoma and Chicago.

Another large project will be the construction of some 1,500 miles of 12- and 24-in. main line and another 1,000 miles of gathering lines by the Coastal Transmission Corp. and the Houston Texas Gas and Oil Corp. between McAllen, Tex., and Miami, Fla. The El Paso Natural Gas Co. expects to install some 1,500 miles of gas gathering lines in Texas, Arizona and New Mexico. The Transcontinental Gas Line Corp. will lay some 700 miles of mainline loop and gathering lines on the Gulf coast and in southern Texas. The Tennessee Gas Transmission Co. plans some 900 miles of line in 1958.

One of the main crude-oil pipelines built in 1957 was the 750-mile, 16-in. line from Aneth, Utah, to Los Angeles. During the coming year, 550 miles of 16-in. line will be built from Aneth to Jal, N. Mex., by the Texas-New Mexico Pipeline Co.

A development of major interest in the product lines during 1957 was the conversion of the Little Big-Inch back to products from Baytown, Tex., to Moundsville, and the construction of 230 miles of 14-in. to Chicago. The biggest of the products lines to be constructed in 1958 is the 440-mile line from Philadelphia to Cleveland, by the Laurel Pipeline Co. This will be the first to use 24-in. pipe for products transportation.

As for foreign fields, there are many more sources to be tapped, and distribution and domestic and industrial consumption are only just beginning. American resources and skills will be required to do the work. Actually, during the next few years, expansion of gathering and distributing systems may well constitute a greater proportion of pipeline work than new trunk lines. Then there is that prosaic but essential and ever increasing work of maintenance, which involves not only lots of money but much engineering know-how.

Dresser coupling, introduced in 1891, had important effect on early pipeline development. It provides flexible leak-proof joint which allows for expansion and contraction. Here straight sections are joined with Dresser couplings to produce a curved line at Monterey Park (Calif.) Reservoir of Metropolitan Aqueduct.

There is an expanding development of Oil-o-static pipelines for high-tension underground electric power transmission. Oil-o-static installations consist primarily of 8⅝-in. welded underground pipelines, filled with oil under pressure, through which high-tension cables are carried. Some oil is introduced into the line (after the pipe has been tested to 500 psi) to provide lubrication in pulling the cable. The system is then filled with oil and kept under a static pressure of 200 psi. The Consolidated Edison Co. of New York is now installing a line in which the oil, under 200-psi pressure, will be circulated and cooled instead of remaining static.

The same company is experimenting with an induction welding process for field use. Some difficulties have been experienced with rough interior surfaces of welds but when this process has been perfected, it will save time and money as compared to conventional welding methods.

Pipelines are in competition with railroads, trucks and tankers as common carriers but it is most difficult to apply the same regulatory principles to all these mediums. Although governmental regulation of pipelines as common carriers has been provided by law for over half a century, many problems remain unsolved by administrative action and court decision. Congressional enactment of the Hepburn Act of 1906 classified all interstate oil pipelines as common carriers. There have been two ways of viewing them, the so-called "horizontal" one in which they are treated primarily as public transportation agencies, and the so-called "vertical" one in which they are considered primarily as a part of plant facilities whereby oil and gas are removed from the earth, gathered, processed, and distributed in one combined operation.

The objectives of those who originally sponsored the regulation of pipelines as common carriers have not been fully realized. There has been much legal controversy and volumes have been written on the subject. However, the regulatory authority of the Interstate Commerce Commission is believed by many to be sufficient to curb any major abuses, and today the public generally thinks of trunk pipelines as one of our principal transportation agencies or common carriers.

Nomograph for intermediate stiffener spacing

A. S. MILGRAM, Member of ASCE Student Chapter, University of Texas, Austin, Tex.

The nomograph presented in Fig. 1 gives a rapid solution to the problem of spacing intermediate stiffeners in plate girders designed under the provisions of the 1949 AISC specification. The specification requires that, if the ratio of clear depth between flanges to thickness of web equals or exceeds 70, intermediate stiffeners be provided wherever:

$$v > \frac{64{,}000{,}000}{(h/t)^2}$$

where

v = greatest unit shear in the panel, psi

h = clear depth between flanges, in.

t = thickness of web plate, in.

Where such conditions exist, the clear spacing between stiffeners is given by

$$d = \frac{11{,}000\ t}{\sqrt{v}}$$

where d is the clear distance between stiffeners, in inches.

The need for stiffeners is determined from the nomograph by joining with a straight edge the points corresponding to the thickness of the web and the clear spacing between flanges. If the resulting unit shear on Scale D is smaller than the actual value in the girder, intermediate stiffeners will be required. Then, by joining the point corresponding to the actual unit shear with the initial point (web thickness), the clear spacing can be read in the middle right-hand scale, C.

The following example is indicated in Fig. 1. Assume that the web thickness, t, is ½ in.; the clear depth, h, is 70 in.; and the greatest shear, v, is 7,000 psi. Connect ½ on Scale A with 70 on Scale B (middle left), and read 3,260 psi on the right-hand scale. Since the actual shear is 7,000 psi, place the straight edge on this point and rejoin it with the web thickness (½ in.) on Scale A. Read on Scale C (middle right) 66 in. (to the nearest inch), which is the required spacing of stiffeners.

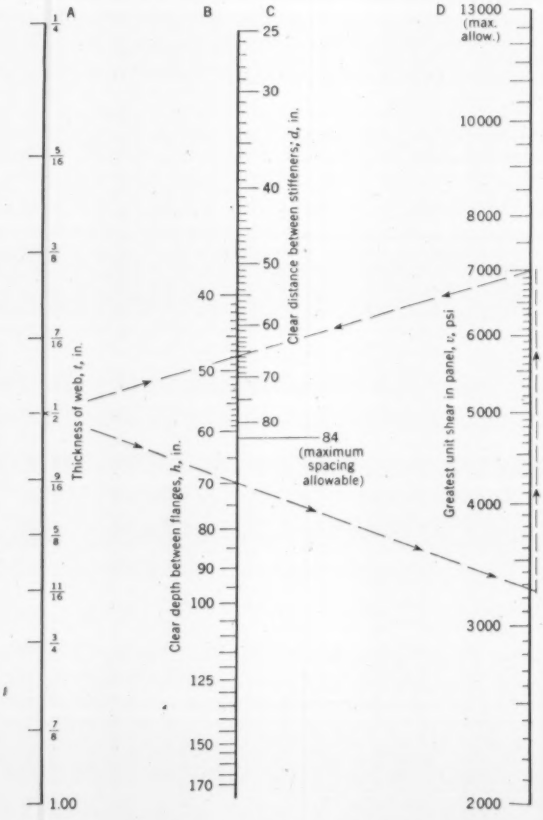
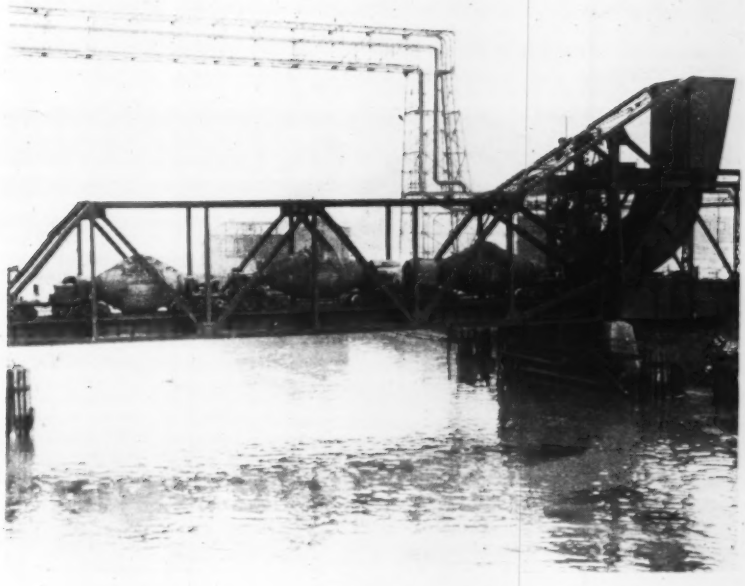


FIG. 1. Nomograph solves problem of spacing intermediate stiffeners in plate girders designed under provisions of 1949 AISC specification.



Scherzer-type bascule bridge supports heavy rail loads crossing Cuyahoga River at Republic Steel Company's plant in Cleveland, Ohio.

Railway bascule strengthened to carry extra-heavy loads

A. L. R. SANDERS, M. ASCE, Partner and Chief Engineer, Hazelet & Erdal, Consulting Engineers, Chicago, Ill.

A bascule bridge of Scherzer type, built in 1913, provides the rail connection across the Cuyahoga River for the Republic Steel Company's plant in Cleveland, Ohio. The bridge owner, the River Terminal Railway Company, decided in 1950 to strengthen this single-track structure so that it could carry Pugh-type hot-metal ladle cars weighing 300 tons each.

The 37-year-old bridge was originally designed for Cooper's E 50 loading, and 50 percent of the impact specified in the 1910 edition of the American Railway Engineering and Maintenance of Way Association for Steel Railway Bridges was used. The bridge was strengthened in 1951 to accommodate a train of 300-ton ladle cars pulled by a 125-ton diesel electric locomotive. The axle spacing and wheel loads are given in Fig. 1. With operating speed limited to 25 miles per hour, impact for vertical effect was taken as 0.6 of the impact specified in the 1949 edition of the AREA Specifications for Steel Railway Bridges. No reduction was made, however, in the impact formulas for rolling effect.

The unit stresses in the strengthened members were limited to 85 percent of those allowed under the AREA Rules for Rating Existing Iron and Steel Bridges, 1949.

All stringers in the bascule span and approach spans were strengthened. Cover plates were welded to the top and bottom flanges. The floor beams in the bascule span and the approach span on which the bascule span rolls, commonly called the track girder span, were likewise strengthened. The 7/8-in. rivets which attached the floor-beam end-connection angles to the floor-beam webs were removed and re-

placed with 1⅛-in. high-strength bolts.

The trusses were strengthened by welding in place bars and plates of the sizes shown in Fig. 2. Sections A-A, B-B, C-C and D-D indicate the location of the added material on the various members.

Because of the relatively low value for rivet shear and bearing used in the original design, it was found that no additional fasteners were needed in the truss joints. A typical truss joint and the welding specified for fastening the added material in place are shown in Fig. 2.

As far as dead load is concerned, the bascule span acts as a cantilever whether closed or being opened. In the closed position, a nominal dead-load reaction is provided by keeping the amount of counterweight below that required for perfect balance. Stress calculations indicated that the material required for strengthening was not unreasonable in amount when added to the members with the bascule in the closed position, except in the case of member U_1U_3. Consequently the work was carried on while the bridge carried normal railroad traffic, thus reducing the time out of service to a minimum. Welding was halted during the passage of a train so that the material could be fastened in place while the truss members carried dead load only. The reinforcing material was added to member U_1U_3, however, with a stationary live load placed on the span in such a position and in an amount sufficient to reduce the stress in this member to zero.

When examined after five years of operation under the greatly increased live load, no evidence of failure in the welds or riveted joints was found.

Stress measurements under operating conditions were made by the Research Center, American Association of Railroads, in August 1955. In some cases the ladle cars had a total weight as high as 654,000 lb. These stress measurements did not indicate a need for further strengthening of those members subject to railroad live load.

Truss member U_0M_a (Section E-E, Fig. 2) undergoes a complete stress reversal every time the bascule is opened. The stress measurements indicated a change in stress of approximately 25,000 psi. Calculations indicate that this member has a tensile stress of about 13,000 psi (on the gross section) in the closed position and consequently about 12,000 psi of compressive stress in the fully open position. This was believed to be too high for a member subjected to repeated stress of the frequency experienced in this structure.

Steps were taken to strengthen this member by adding bars, as indicated in Section E-E, Fig. 2, while the bridge was in the closed position. The area of the reinforcing material was proportioned to take all the compressive load in the fully open position, thus reducing the stress in the original material when in that position to zero. The net result is that there now is no reversal of stress in the parts making up the member.

While the general strengthening of the bascule was under way, the overloaded tread and track plates on which the structure rolls were replaced with alloy steel plates. The machinery and electric equipment were likewise completely renewed and modernized. The original hand chains for emergency operation were removed and an air motor installed for this purpose. A portable air compressor is moved to the bridge site when it becomes necessary to use the air motor for bridge operation.

Hazelet & Erdal, Chicago, Ill., acted as consultants on the work. Leonard Larson, Chief Engineer of Republic Steel Corporation, and E. J. Lisy, Valuation Engineer for the River Terminal Railway Company, reviewed the plans and supervised the construction.

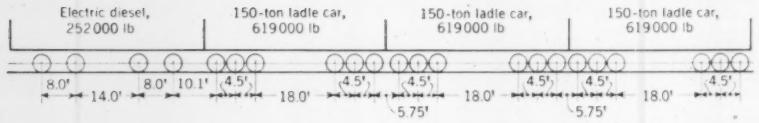
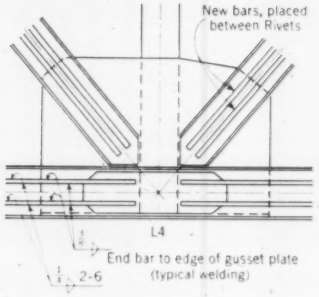


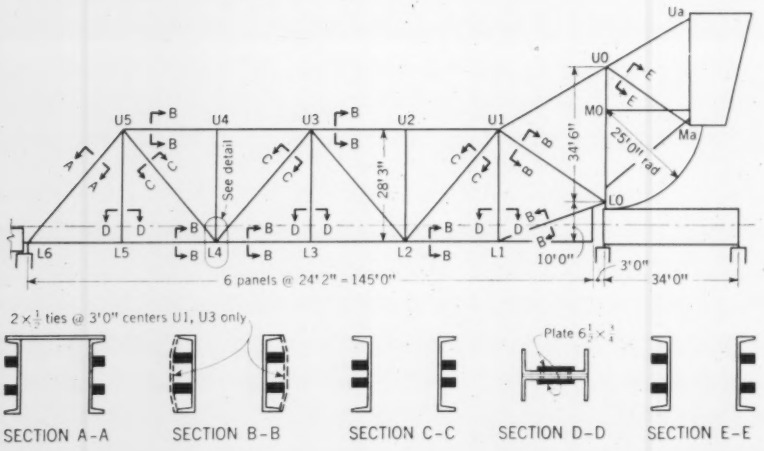
FIG. 1. Single-track bascule was strengthened to accommodate a train of 300-ton ladle cars pulled by 125-ton diesel electric locomotive. Load per wheel is 31.5 kips for locomotive, 51.6 kips for ladle cars.



TYPICAL TRUSS JOINT

FIG. 2. Two trusses of 37-year-old railway bascule were strengthened by welding on, in place, bars and plates of sizes listed below:

L_0U_1: 4 bars, 4 X 1¼	U_0M_a: 4 bars, 3 X 1½
U_1U_3: 4 bars, 5 X 1½	L_0L_1: 4 bars, 3 X 1¼
U_3U_5: 4 bars, 4 X 1½	L_1L_2: 4 bars, 3 X 1⅛
U_5L_6: 4 bars, 3 X 1½	L_2L_4: 4 bars, 4 X 1 7/16
U_5L_5: 4 bars, 3 X 1	L_4L_6: 4 bars, 2 X 1 1/16
U_5L_4: 4 bars, 3 X 1⅜	U_1L_1, U_3L_3, U_5L_5:
L_0U_5: 4 bars, 1½ X 1½	2 plates, 6½ X ¾



THE READERS WRITE

Giant spikes fail to halt earth movement

To the Editor: A news item in the January issue, p. 96, describes the placing of giant "spikes," really a type of concrete caisson reinforced with double rings of vertical steel bars, to stop earth movement along a slide zone in a residential area just south of Los Angeles. It was there stated that the caissons or pins had slowed movement from 1¼ in. to 0.3 in. a day, and geologists expected the slippage would soon be stopped permanently.

A letter from Donald F. Warren, J.M. ASCE, dated January 24, 1958, indicates that the high hopes entertained for the success of this method have not been realized. The Donald R. Warren Company, Engineers, were retained by the County of Los Angeles to determine the feasibility of placing a rock revetment and earth fill at the toe of the slide to stop the movement and protect the County's investment in the slide area. The actual situation is as follows.

The present landslide started in August 1956, and continues to this date, the maximum horizontal movement being about 35 ft. It is located in an area of ancient slides. Parts of the sliding area are thickly populated. It was decided that the shear pins with half their length embedded in the solid strata below the slip plane offered a possibility of stopping the slide, or slowing it down until more certain methods could be employed to stop it permanently. It was recognized that there was no precedent to guide the work, and that there were factors which could not be determined.

When the County of Los Angeles decided to install the pins, it was understood by all concerned that it was on an experimental basis with a probable chance of success.

Fifteen pins were placed by the County in July and August 1957. Ten similar pins had previously been placed by others. Daily measurements of earth movement at numerous points were made from September 1956 to December 20, 1957. Since the latter date readings have been made twice weekly. Control points were set by first-order surveying and daily measurements were made by second-order methods. At the time the last pins were set, the daily movement at the surface near the pins was about 0.08 ft. At present, there have been fluctuations in daily movement, but no significant reductions in rate, the daily movement being now about 0.07 ft at the point of maximum motion. That the movement is continuous is also borne out by visual land distortion and increasing damage to structures.

Observations made on December 4, 1957, showed that the pins were bent at their mid-height, and incipient crushing was noted at the same point. The tops of the pins have moved from 4 ft to nearly 12 ft in the direction of the slide.

In view of the foregoing facts, it must be concluded that the pins did not measurably decrease the rate of the slide, have apparently failed, and are not able to restrain the slide motion. This correction is offered to avoid misleading anyone who may be faced with a similar problem.

John A. Lambie
County Engineer
County of Los Angeles
Los Angeles, Calif.

It's time for a new type of engineering education

To the Editor: The report of the Task Committee on Professional Education, in the February issue, is a timely document. It is to be hoped that it will be fully discussed by the membership through the columns of Civil Engineering. With this thought in mind I offer the following comments.

The Task Committee notes in paragraph (1) of the Summary that "the civil engineer is a professional man, and he must be trained as such" (p. 67). It then proceeds to discuss his education and concludes by suggesting an undergraduate curriculum. This may be good and is perhaps the only practical way to attack the problem at this time. Nevertheless the writer believes it is time for the profession to break with current academic practice and to work towards a new type of education for the civil engineer.

Is it not time for the profession to demand:

1. Preprofessional education—perhaps common to all engineers.
2. Professional education.
3. Post-professional education in specialties.

Such an approach would enable:

Academic institutions: (1) To offer one professional degree (perhaps the CE of comparable stature to the MD) and thus eliminate the necessity for multiple degrees except for advanced work in specialties; (2) to more adequately staff its three divisions (preprofessional, professional and post-professional specialty); (3) to turn out better civil engineers for the world of tomorrow.

The student: To meet his own objectives more effectively.

The employer: To differentiate more effectively between the professional man and the technician.

The civil engineer: To become more truly a professional man.

A. A. K. Booth, M. ASCE
2 Bolivar Ave.
Troy, N. Y.

No shortage of civil engineers

To the Editor: The Task Committee on Professional Education is to be complimented on its comprehensive report published in the February issue. I agree with all its conclusions except No. 6, which states, "There is a distinct shortage of engineers."

Based on my own personal experience and a general knowledge of studies presented by others, I do not agree with this conclusion. Nowhere in the report is there any evidence to substantiate this statement. In fact, I believe the survey results indicate that the exact opposite is the case.

To say that there is a distinct shortage of engineers is parroting the cry of firms that require the services of applied physicists, mathematicians, etc. It is true that people with this type of training are in demand and the want ad columns are directed towards such individuals. However, when we talk specifically about civil engineers we should not be misled by statistics which are averaged and weighted with other branches of engineering or applied science.

During the past 10 years I have heard much talk concerning the future shortage of civil engineers. During this time I have not seen this shortage materialize. How many more years must we continue to plot curves showing future shortages, while we contend with surpluses?

An article in the February 15, 1958, issue of *Business Week* discusses contract awards and the problems of defense plants. The last paragraph is significant: "Most companies, however, foresee little trouble with shortage of engineers."

Stephen M. Olko, A.M. ASCE
Consulting Engineer
New York, N. Y.

SOCIETY NEWS

United Engineering Center— A Challenge to the Profession

Raising $10,000,000 is quite a job. It becomes even more of a task when part of the fund must come from professional men.

Very fortunately, in its campaign to raise $10,000,000 for a United Engineering Center, the engineering profession has the firm support of industry, which has already raised more than half its allotted share of $5,000,000 for the Center. With the present resources of United Engineering Trustees estimated at $2,000,000 (which will include the sale of the present Headquarters building on 39th Street), the tab for all the engineering societies that will use the new Center is $3,000,000. Of this $3,000,000 total, ASCE has accepted the sum of $800,000 as its share.

The fact that ASCE has selected certain construction firms and contractors for inclusion in its fund-raising program will help to meet the quota. Nevertheless, $800,000 is a very substantial sum, and to raise it the full and generous cooperation of every member will be needed.

The member-giving campaign is now getting started. Realizing that the strong support of the New York area is essential to the success of fund-raising efforts on a national scale, our Metropolitan Section is already hard at work fulfilling what it regards as its obligation. The pattern of activity it has established may be helpful to the other Local Sections.

In its initial stages the Metropolitan Section campaign consists of canvassing about 150 of its members of the Society who have been carefully selected as likely prospects for substantial contributions. By means of a committee specifically created for the purpose, each of these prospects is to be contacted personally for his pledge.

In the New York area also there will be a special Business Campaign to raise funds from commercial and business firms. This campaign is headed by William H. Byrne, a regional vice-president of the ASME. The Greater New York Business Campaign will complement the Industry Campaign under the chairmanship of Dr. Mervin J. Kelly and the Member Gifts Campaign headed by ASCE Past-President Richard E. Dougherty. It will be remembered that ASCE Past-President Enoch R. Needles heads the Society's Member-Giving Campaign.

Members across the country are being contacted for contributions this spring by the special committee created for the purpose. Additional prospects for substantial gifts are to be determined by Local Section officials, and these too will be approached in person. On a nationwide basis, ASCE Directors will initiate and supervise the campaign in the Local Sections, each in his own District. They will see that Section officers are properly informed, and provide any needed assistance in getting the local campaigns off the ground. The Vice-Presidents will be responsible for general supervision of the campaign in each of their Zones.

Charles F. Kettering, Honorary Member of the Society and honorary chairman of the Member Gifts Campaign, points out that today, with "the significance of engineering being recognized as never before, the engineer needs an adequate platform from which to expound his efforts as a creator of economic and social values. He needs a symbol of his dynamic purpose." In a call to engineers to rally to support of the campaign for funds, Mr. Kettering hails the new United Engineering Center as "a focus of life for sixteen national engineering societies," and says it will provide "the platform and the symbol" needed.

Demolition work at the site of the new United Engineering Center is witnessed by Walter J. Barrett, president of United Engineering Trustees, Inc., and William H. Byrne, general chairman of the Greater New York City Business Campaign for funds for the Center. David A. Glick is foreman for the International Wrecking Co. which has the contract for clearing the site. Razing of old structures was completed in March, and actual groundbreaking for new construction is set for later this year. The new 20-story Center, to be built on United Nations Plaza between 47th and 48th Streets, New York City, is expected to be ready for occupancy in the fall of 1960.

Chicago Convention Reviewed

Not since the Society's Centennial celebration in Chicago during September 1952, has the Illinois Section been host to an ASCE Convention. Again, cool efficient Frank W. Edwards, who was general manager of the Centennial program, was drafted to head up the committee that arranged and sponsored the recently completed ASCE Convention in Chicago.

The week-long Convention, held in the Sherman Hotel, February 24-28, featured up-to-the-minute programs put on by each of the Society's 14 Technical Divisions—41 sessions in all. An enlightening general session on electronic computation was attended by an enthusiastic audience of 750. Two special sessions and a luncheon of the Department of Conditions of Practice attracted attentive listeners. At the general session on Wednesday Richard J. Daley, mayor of Chicago, welcomed the civil engineers, praised their contribution to the development of Chicago, and announced that he had named a civil engineer, John G. Duba, M. ASCE, as his executive assistant to coordinate all construction in the city.

At a Student Chapter Conference an ebullient group of young engineers from 44 Chapters talked about ways of improving Chapter operations. Among the half-dozen tours of inspection to public works and laboratories, was an unusually interesting visit to the 180,000-kw Dresden Nuclear Power Plant, now under construction and to be completed in 1960. Particularly well attended were the joint sessions, both technical and social, with the American Concrete Institute which was holding a concurrent convention in the nearby Morrison Hotel (see page 96). While more than 140 technical and professional papers were being read, the Board of Direction and its committees were meeting, as were 25 enthusiastic Division committees intent upon plans for enlarging and improving the quality of the technical output of the Society.

The attendance of more than 1,700 was one of the largest at a Convention not held in New York City. Assisting General Chairman Edwards were the officers of the Central Illinois and Tri-City Sections, and a small army of willing Illinois Section men and women who handled the multiplicity of details concerning money, hotel reservations, the impressive technical and social programs, the smoothly run registration desk, the reception center, public relations, student activities, and the very important program for the feminine contingent. The program for the ladies was arranged and managed by a committee of 20 headed by vivacious Mrs. Virgil E. Gunlock.

Why High School Students Choose Engineering

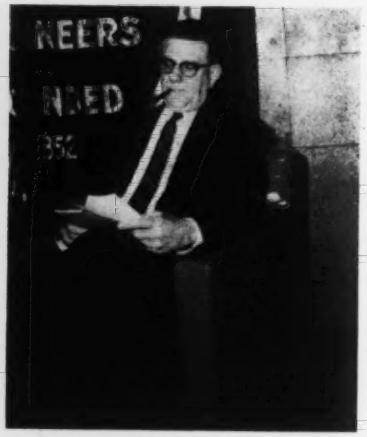
At least one ASCE Local Section has concerned itself with finding out why there is a shortage of engineers in its area and what can be done about it. The San Diego Section's Committee on Student Activities, with Bert C. Wilkas, A.M. ASCE, as chairman, presented its report, at one of the Conditions of Practice sessions, on how "Six Thousand High School Students View Engineering and Scientific Careers." The informative survey was the result of a cooperative effort of the Section and the County Superintendent of Schools. "Let's ask the high school students," they con-

Mayor Richard J. Daley welcomes ASCE Convention to Chicago. President Louis R. Howson responds for the Society.

President Howson presents Mead Prize for Junior Members to previously announced winner, Robert Braden, of Houston, Tex. With them is ASCE Director Clinton D. Hanover.

Three prominent research engineers—Dr. Bruce G. Johnston, Dr. Lorenz G. Straub, and Dr. Mikael J. Hvorslev—were awarded the Society's Research Prize for 1957.

Convention Luncheon speaker, Dean Martin A. Mason, tells engineers they must assume responsibility for developing wider knowledge of the profession.



Dean C. K. Weidner, of American University in Beirut, addresses Convention on "Sputniks, Flopniks, and the Future of the United States."

cluded, "about their attitudes with respect to their choice of a career after graduation, then apply the correction measures indicated." A questionnaire of the forced-choice type was prepared and submitted to the tenth-, eleventh-, and twelfth-grade students in 15 San Diego County high schools, in order to investigate two areas of thought. It asked:

1. Do you have enough information at your disposal to make an intelligent choice regarding your future occupation?

2. If your occupational choice was in a field other than science or engineering, what was the basis for your decision?

Six thousand usable responses, almost equally divided between boys and girls, were analyzed and tabulated the hard way, without recourse to costly electronic machine assistance, by expense-conscious members of the Section.

The answer to the question, "Why do high school students choose engineering?" appears to be very closely related to whether the student likes science and mathematics. The students indicated that a *dislike* for science and mathematics courses, rather than insufficient salaries or too few scholarships was the principal *deterrent* to the selection of a science-related occupation. Other conclusions are that stimulation of occupational interest takes place before the tenth grade, which points to the need for career guidance in the early high school years. A large majority (97.4 percent) of the students felt that they had been adequately informed on the various aspects of occupational choice and were able to make such a choice.

Although the report stated that there are evidences of increasing interest in engineering and science by high school students among the boys; among the girls there appears to be an area for further action—namely, develop some of the badly needed science and mathematics teachers from the fair sex.

The Engineering Profession Scolded

Engineering societies were given a sound scolding for not talking authoritatively to the public, by press, radio, and television, on the present state of American engineering. The scolding came from Dr. Martin A. Mason, M. ASCE, dean of the School of Engineering, George Washington University, Washington, D. C., Convention luncheon speaker.

"Recently," said Dr. Mason, "Americans generally, and the engineering profession particularly, have been subjected to a rude shock. People are suddenly afraid, because an unfriendly nation achieved an engineering feat before we did, and now they are concerned about American science and engineering.

"Congressmen, columnists, and commentators have discoursed learnedly," he pointed out, "without knowing much of the state of American engineering; but our profession has brought nothing to the public on this matter." It is the public that supplies "the money and need for defense, public works, private industry, and the whole complex of engineering activity."

"Some little comment has appeared in our technical publications . . . but the public does not read our publications . . . they gain what they do know primarily from newspapers, magazines, radio and television."

He deplored the fact that, because most engineers are employees, they have little opportunity for "excursions of discovery into the vast area of the unknown that made them engineers in the

Structural Division executive committee is hard at work in this view. Its members are (in usual order) Myle J. Holley, Jr.; Robert D. Dewell; Elmer K. Timby; Leo H. Corning, chairman of the executive committee of the Division; and George S. Vincent.

Pipeline Division Luncheon featured talk by William R. Connole (second from right), commissioner of the Federal Power Commission. In usual order are Joseph B. Spangler, secretary of Division; Eldon V. Hunt, chairman of executive committee; Commissioner Connole; and F. C. Culpepper.

first place." Deadlines, competitive production, military directives, security classifications, company policies, and economic necessity soon smother creative and imaginative ideas, he said.

"In our society the individual engineer . . . is almost powerless to act alone to change this situation." Dean Mason said that he feels sure the profession as a whole, and particularly the engineering societies, must assume this responsibility for the individuals who make up the profession. He asked some pertinent questions that he believes cannot now be answered in the affirmative:

"Has the profession defined the frontiers of engineering, and is it vigorously attacking these frontiers?"

"Dependent as the profession is on research, do the engineering societies support basic research in adequate amounts?"

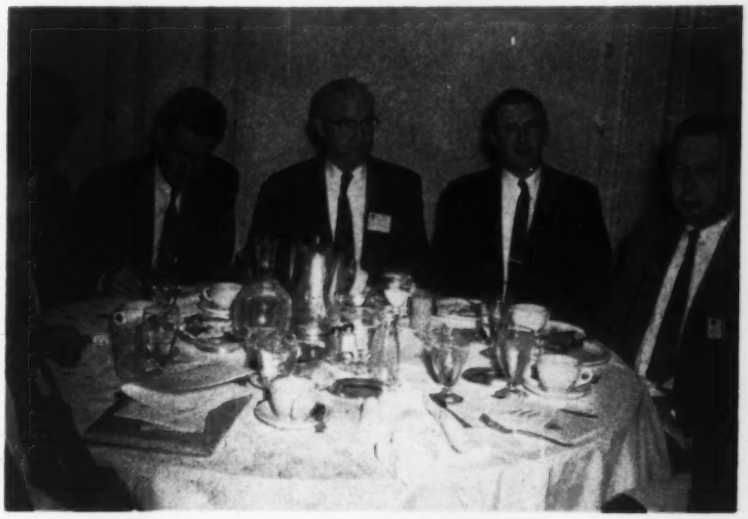
"Do we present and support a united professional front as engineers, regardless of specializations and employer?"

"Is the profession doing an effective job of creating public awareness of the nature and importance of engineering?"

He pled with his audience to insist that professional groups as a unit take the lead from columnists and government officials in matters of concern to the nation, involving science and engineering, about which they can speak with authority and knowledge.

Improve Employment Conditions

From another source came an eloquent plea for the Society to exert more leadership and effort toward improving the conditions under which employed civil engineers work. Robert D. Darragh, president of the Junior Forum of the San Francisco Section, in a talk on "Engineers, Unions and ASCE" on behalf of his Forum, spoke in favor of ASCE leadership in the control of professional registration by setting up state advisory committees and by establishing local committees on professional conduct. His group feels that ASCE properly should influence legislation, particularly with recommendations on labor laws affecting engineers; should make salary recommendations; and should review and give advice on public works projects. Also, he pointed out, ASCE should revise its fee structure as a step toward better salaries for engineers employed by consultants. It should take positive steps to improve the quantity and quality of both preengineering and engineering education. More Junior Members should be convinced of the need for their active participation in Society work. Finally, ASCE's public relations program should develop pride both in and out of the profession in the accomplishment of civil engineers.



Irrigation and Drainage Division speakers plan session at one of the daily Authors' Breakfasts. Left to right are Howard T. Critchlow, chairman of Division's executive committee; Orson W. Israelson and his son, O. A. Israelson; Kenneth Q. Volk; Franklin Rogers; and D. F. Peterson, Jr.

Opportunities Unlimited

On a more optimistic note Jack Y. Long, M. ASCE, Oakland, Calif., told the Convention that the opportunities confronting civil engineers "appear to be limitless." Although the rise in our economy is experiencing a leveling off, he pointed out that "this does not mean a recession. Public works programs are available to meet any slow down in construction . . . civil engineering skills will be needed to carry them out," Mr. Long observed.

"The increased need for transportation has brought opportunity to men in highway, freeway, and bridge design," he said. A trend toward a more urban type of living over the past 30 years has presented many opportunities for engineers to exercise their skills in the civil field. As examples he pointed to the heavily populated urban areas that need rapid transit systems; the growing air travel that requires modernization of airports and airport facilities; and the mushrooming communities that require land development, adequate water supply, drainage, sanitary facilities, and public utility services. "The trend to the city manager system of local government has given opportunity to civil engineers interested in management problems."

In addition to abundant opportunities for civil engineers to utilize their training and skills, Mr. Long emphasized that the profession has problems which need active attention. Among them the profession needs to evaluate the trend toward the kind of specialization that tends to make civil engineers technicians rather than professional men. We should develop and utilize our abilities to improve public knowledge of the contribution of civil engineers to public health, comfort, and safety. Fundamental to these needs is the overriding need for civil engineers to increase their interest in their own professional organization, so that it can be effective in providing professional advancement, Mr. Long concluded.

Recognition for Achievement

Three prominent research engineers, members of the Society, were honored by the presentation of the 1957 Research Prize to them during the Convention. President Howson presented certificates and cash awards of $100 each to Dr. Bruce G. Johnston, for his research on the behavior of steel structures; Dr. Lorenz G. Straub, for his extensive research in hydraulic engineering; and Dr. Mikael J. Hvorslev, for his development of useful methods for testing soils and exploring subsurface conditions. More complete biographies of the Research Prize awardees appeared in the January issue.

The previously announced winner of the Daniel Mead Prize for Junior Members, Robert Braden, of Houston (February issue, page 80), received his certificate and check for $100 during one of the Conditions of Practice sessions.

Technical Program Featured Midwest Projects

No branch of civil engineering was slighted in the Chicago Convention technical program. Many of the 140 papers presented will appear in CIVIL ENGINEERING or in the Journals of the Technical Divisions. Brief editorial comments about a few of the papers follow. Engineering achievements in Chicago and the problems of the Midwest area were conspicuous on the technical program, although the geographical area covered by the papers extended from Massachusetts to California.

John G. Duba (left), active chairman of Public Relations Committee and author of Convention paper, is greeted by Mayor Daley. Mr. Duba recently received an appointment as executive assistant to the mayor.

Future of Chicago's Water System

Addressing the Sanitary Engineering Division, W. W. De Berard, Hon. M. ASCE, deputy commissioner for water and chief water engineer of the Chicago Department of Water and Sewers, reported that the all-time maximum day demand for water in Chicago has risen to 1,513 mgd, and that water rates, formerly the lowest of any big city in the United States, were doubled in 1951 —from 8 to 15 cents per 1,000 gal—to provide funds for needed expansion of the water works system. Inadequacies in the system were revealed in a striking way during the long period of hot weather in 1953 when tunnels, pumping equipment, and feeder mains were taxed beyond their capacity to convey water.

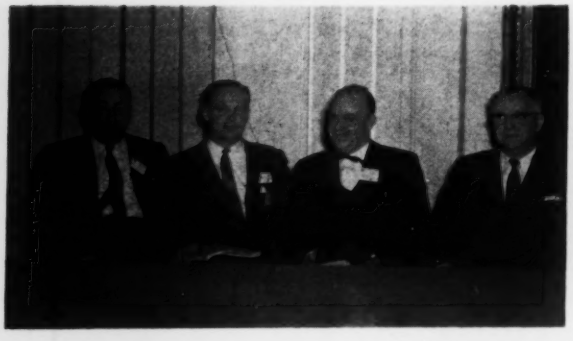
"Up to this time [1953], no agency outside of the city organization had made a comprehensive survey of the water situation," said Mr. De Berard. The city, in 1954, retained the engineering firm of Alvord, Burdick and Howson to review the plans of the city's engineering staff for providing service both to Chicago and its suburban customers, to outline a plan for expanding the system over the next 25 years, and to develop a plan for financing the construction, operation, and maintenance of the expansion. The required water works construction was estimated by the consultants to cost close to $300 million. On May 1, 1957, water rates were again increased (from 12 to 16 cents per 1,000 gal) to finance the work. The consultants estimated the 1980 water requirement for the maximum day at 2,410 mgd.

"Our capital improvement program for the five-year period, 1957-1961," said Mr. De Berard, "contemplates an expenditure of $157 million. . . . Under construction at the present time is the new Central District Filtration Plant and connecting tunnels . . . started in 1952 and scheduled to be completed late in 1961 at a probable cost of $100 million (see the March issue).

Fred G. Gordon, M. ASCE, assistant chief engineer of the Chicago Department of Public Works, which has charge of the construction of the Central District Filtration Plant, said that the plant is conventional in design, but that its size presented unusual engineering problems. Located in a 60-acre cofferdam fill on the shore of Lake Michigan, north of the Navy Pier, the plant will permit operation at a filter rate of 3.5 gal per sq ft per min—a plant capacity of 1,680 mgd.

Among the problems was the selection of the low-lift pumps to meet "pumpage rates varying from 400 to 1,700 mgd; a limitation by the power company on starting input of motors; varying heads on suction and discharge; and the need to conserve space. The size of the pumping units was fixed by the largest motor which could be used—1,500 hp. Smaller

Construction Division speakers say young construction engineers are needed. Here (left to right) are Walter L. Couse; Robert Banks, chairman of Program Committee; John Zimmerman; and Harry L. Conrad.



W. W. De Berard, Hon. M. ASCE, Chicago's chief water engineer, plans sanitary engineering session with other speakers. Seen here are H. H. Gerstein, F. C. Gordon, Mr. De Berard, and George S. Salter.

units were selected to provide a smooth transition from minimum to maximum pumping."

Off-Street Parking

Chicago's $50 million off-street parking program is "not a cure-all, but one of the principal medicines which Chicago has taken in large doses in addition to other forms of traffic congestion therapy. Dick Van Gorp, M.ASCE, chief engineer of Chicago's Department of Public Works, agreed that the city is "still suffering some traffic aches and pains, but the program," he added, "thus far is paying off."

So far the city has built 10 multilevel and 36 surface parking lot facilities with a combined capacity of 10,521 cars. Facilities for 4,000 more cars are to be completed under the present program.

These parking facilities are being financed by revenue bonds amortized from off-street parking fees and on-street parking meters. In 1957, the gross revenue was just over $5 million. "To date," said Mr. Van Gorp, "revenues are well within the range of supporting this program."

Calumet Skyway

Chicago's new $100 million Calumet Skyway, a toll bridge and elevated embankment 7¾ miles long, linking Chicago's South Route Superhighway with the Indiana Toll Road, is being opened to traffic in April. This was announced by John G. Duba, M. ASCE, new executive assistant to the mayor of Chicago and coordinator of all engineering projects in the city. Mr. Duba pointed out that this new traffic facility is the final link in a 1,000-mile tollway extending from the East Coast to Chicago.

The skyway provides for three 12-ft traffic lanes in each direction with a raised median strip 4 to 12 ft wide throughout the length of the facility, with 11-ft paved shoulders along the right lane except on structures. The principal structure is the high-level three-span cantilever bridge over the Calumet River. The spans are 325-650-325 ft in length, clearing the river vertically by 125 ft. Tolls for passenger cars will be 25 cents, for trucks $1.00. Mr. Duba said that the revenue anticipated during the first year of operation is estimated at $5 million, derived from the 15,000,000 vehicles expected to use the facility.

Highways

Speaking before the Highway Division luncheon, George M. Williams, M.ASCE, assistant commissioner of the U. S. Bureau of Public Roads, revealed that reports from the 48 states and the District of Columbia show that the new Interstate System of Highways will total 38,548 miles. The total cost of $39.5 billion is divided into $22.3 billion for 4,568 miles of urban roads, and $17.2 billion for 33,980 miles of rural roads. Four-lane highways (32,173 miles or 83½ percent) will predominate; 2,142 miles will be toll roads.

An impression of the vastness of the highway program may be derived from the number of structures needed solely on the 33,980-mile rural portion of the Interstate System: 220 bridges over 1,000 ft long, 6,765 shorter bridges, 8,763 traffic interchanges, 9,546 highway separations, 1,452 railroad separations, 405 highway-railroad separations, and 20 tunnels over 500 ft long.

"These reports," said Mr. Williams, "are ready for Congress with a recommendation that they be approved as the basis for apportioning funds for the Interstate System for the three years, 1960-1961-1962, such that the rate of construction in each state will be uniform."

Pipelines

ASCE's infant Pipeline Division is indeed a fast-growing husky infant. Pipelines carry petroleum products, various slurries of coal and other ores and, from time immemorial, water. Their design, construction, operation and maintenance are fundamental responsibilities of civil engineers.

The largest water supply project ever envisioned by man is California's $1½ billion Feather River Project. It contemplates "the transfer of surplus water from the northern part of the state to meet the ever-growing demands of the vast agricultural lands and the ever-expanding metropolitan areas in the southern portion of the state," said R. M. Edmonston, J.M.ASCE, principal hydraulic engineer for the state's Department of Water Resources. Unprecedented construction problems are presented in conveying 2,500 cfs of continous flow through the 300 miles of rough terrain separating the San Joaquin Valley from the southern part of the state. This is the most difficult part of the 750-mile aqueduct route extending from Oroville Dam on the Feather River, north of Sacramento to the Mexican border south of San Diego.

What is the most economical combination of pump lifts, power drops, tunnels, siphons and conduits, and the optimum position of the hydraulic grade line? A method for determining the best grade line, developed by E. E. Jackson, joint author of a paper presented before the Pipeline Division, is based on an application of the calculus of variations to the most general possible expression of conduit costs. The integral which expresses total conduit cost is differentiated to derive equations that govern the establishment of the hydraulic grade line. Mr. Jackson is in the state Division of Water Resources at Los Angeles.

Dr. Nathan M. Newmark, chairman of General Session on Electronic Computation, introduces speaker John J. Kozak.

John Kondela, Jr., demonstrates the new Burroughs E101 Computer during Convention Exhibit of computers.

Highway Division Luncheon features talk by George M. Williams, assistant commissioner of Bureau of Public Roads; Pictured, left to right, are W. H. Wisely, Executive Secretary of ASCE; J. P. Buckley, secretary of Division's executive committee; Mr. Williams; ASCE President Louis R. Howson; Director R. Robinson Rowe; and Norman Kennedy.

High-Speed Computers

Conventioneers received full information on electronic computers, both theory and practice. A week-long exhibit of four types of digital computers attracted continuous attention. A well-attended general session, arranged by the Structural Division, included papers by some of the more expert users of the new tool. A spirited general discussion by members of the Electronics Computation Committee of the Division followed.

The Convention was told that high-speed computers solve civil engineering problems unbelievably fast; but that no matter how much they cost, they have no brains. They cannot think; they can only do what they are told to do. No one has yet found a way to insert a four-year college education and a number of years of experience into a computer. A computer is a slave. Engineers who are their masters, still must do the thinking.

"In the past, civil engineers have spent half their productive lives performing mathematical computations," said H. A. Radzikowski, of the U.S. Bureau of Public Roads. "Now he has an electronic assistant. Just over two years ago the use of electronic computation in highway engineering began. Today 28 state highway departments have installed computers, and another 12 have said they intend to. At least 20 of the leading highway engineering consultants have installed computers and many more intend to do so."

On highway work alone, Mr. Radzikowski named 31 problems now being solved by computers with impressive savings in time. In solving the complicated alignment problems found in complex interchanges, 350 man-hours of calculating time can be reduced to one machine-hour.

[With the enthusiastic cooperation of the Computation Committee of the Structural Division, of which Dr. Nathan Newmark is the chairman, the editors have obtained articles from a number of computer experts for publication in May CIVIL ENGINEERING. Some of these articles will be by Chicago Convention authors.]

What the Board Did in Chicago

During the Chicago Convention the Board of Direction met in the Sherman Hotel on February 24 and 25, with all but one member present and with President Howson in the chair. Some of the actions taken by, or reported to, the Board follow.

Technical Publications

The Publications Committee, of which Howard F. Peckworth is chairman, reported that the Technical Divisions' operation of their publication procedures is developing in a very satisfactory manner. It is estimated that 70 more Proceedings (Journal) papers will be cleared by the Divisions and published this year than was anticipated at the beginning of the fiscal year—400 instead of 330. The Board approved a requested increase of $25,000 in the publication budget for Proceedings papers to cover the added production and mailing costs.

Manuscripts for thirteen Manuals of Engineering Practice are in preparation by Division Committees.

The Board approved a recommendation of the Committee to continue the special "Journal of the Board of Direction" without change in scope but to change its name to the *Journal of Professional Practice*. In its new form the Journal will be under the responsibility of the Department of Conditions of Practice which will review and clear papers assigned to it in the same way that the Publication Committees of the Technical Division do now. A Publication Committee for the Department was authorized. Members will obtain copies of the *Journal of Professional Practice* by filling out the standard coupon which appears each month in CIVIL ENGINEERING and returning it to Society Headquarters.

Society Conventions

Several invitations to the Society from the Local Sections for forthcoming Conventions were accepted. There follows a complete list of Society Conventions to the extent that they have been scheduled.

1958	June 23-28	Portland, Ore.
	Oct. 13-17	New York, N. Y.
1959	Feb. 8-13	Los Angeles, Calif.
	May 4-8	Cleveland, Ohio
	Oct. 19-22	Washington, D. C.
1960	Mar. 7-11	New Orleans, La.
	June 19-25	Reno, Nev.
	Oct. 9-13	Boston, Mass.
1961	April 10-15	Phoenix, Ariz.
	Summer	Not scheduled
	Oct. 16-20	New York, N. Y.
1962	February	Houston, Tex.
	May	Omaha, Nebr.
	Oct. 15-19	Detroit, Mich.

Classification of Members

The Task Committee on Classification of Members, of which Frank L. Weaver

is chairman, made its second report to the Board, after having given full and careful consideration to all the views and comments received from Local Sections, various committees, and individuals. It was essentially a reaffirmation of its Interim Report of June 3-4, 1957, to the Board at Buffalo (see CIVIL ENGINEERING, July, page 81). After lengthy discussion by the Board, the Committee was directed to obtain the written reactions of individual members of the Board and report again at its Portland meeting.

Commercial Exhibits

Vice-President Francis Friel, reporting for the Task Committee on Convention Policy and Practice, recommended that the Board authorize commercial exhibits at Annual Conventions of the Society, wherever held, and empower the committee to authorize the conduct of commercial exhibits at other than Annual Conventions when the best interests of the Society will be served. The Board voted approval.

Department of Conditions of Practice

On request of the Department's Executive Committee, the Board approved a second meeting this year of the Committee on Engineers in Public Practice and appropriated $1,500 for the purpose.

Formation of a *Committee on Publications* of the Department was authorized. This committee will handle review and editorial functions of the new *Journal of Professional Practice*.

The *Committee on Engineering Education* reported that the initial printing of 150,000 copies of "You Can Be a Civil Engineer" has been exhausted and requested authorization to reprint an edition of 50,000. The Board approved the request and appropriated $5,500 for the purpose.

The *ECPD Definition of Engineering* was endorsed as follows:

> "Engineering is the profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the progressive well-being of mankind."

Local Sections

A New Hampshire Local Section was authorized. Formation of new Local Section Branches was approved as follows: East Coast Branch (Orlando), of the Florida Section; Colorado Springs Branch, of the Colorado Section; and Redwood Empire Branch (Santa Rosa), of the San Francisco Section.

The Local Section Conference, planned for Portland in June, was cancelled in favor of a similar Conference to be held at Helena, Mont., in conjunction with the Spring 1959 Pacific Northwest Conference. A Local Section Conference was also authorized in conjunction with the May 1958, Texas-Louisiana Section meeting at Beaumont, Tex. It will include the following Sections and their Branches: Texas, Oklahoma, Louisiana, Mid-South, Kansas, and Mexico.

Contact Member Craig P. Hazelet, of the *Committee on Professional Practice*, reported that the revised draft of Manual 29 on the Practice of Civil Engineering is expected to be ready for Board consideration at the committee's Portland meeting. The fee study is still under way. Specific fees for use in connection with highway projects are to have the special attention of a group consisting of three consulting engineers, three state highway officials, and Messrs. Howson, Kennison and Requardt, representing the committee.

The Board voted approval of the contents of the Engineers Joint Council document, *The Practice of Consulting Engineering* (EJC Report No. 106) as a supplement to but not a replacement of ASCE Manual 29. [Copies of the EJC Report, No. 106-1957, can be obtained from Engineers Joint Council, 29 West 39th St., New York 18, N. Y., for $1.50.]

The draft of the proposed Standard Form of Agreement between engineers and architects was referred back to the ASCE-AIA Joint Cooperative Committee to clear several remaining corrections necessary for ASCE approval. Messrs. Hazelet and G. J. Requardt were named to meet with the Joint Committee for this purpose.

The *Committee on Professional Practice* reported that the practice of fees payable to architects by engineers and by engineers to architects when a member of one profession engages the services of a member from the other varies so greatly in different parts of the country that it is not feasible to establish a standard fee. The Board accepted this conclusion and relieved the committee of its assignment.

A proposed "Recommended Guide to Bidding Procedures on Engineering Construction," the work of the ASCE-AGC Joint Cooperative Committee, was reviewed and referred back to the Cooperative Committee for clarification of certain paragraphs, and for consideration of comments by the Committee on Professional Practice.

The *Committee on Professional Practice* asks members to report to the Secretary incidents of competitive bidding on a price basis as they occur, so that steps can be taken to discourage the practice. The cooperation of the American Public Health Association, the American Water Works Association, and the Federation of Sewage and Industrial Wastes Associations in reporting incidents of competitive bidding will be sought.

United Engineering Center

Past-President D. V. Terrell, ASCE representative to United Engineering Trustees, reported the progress to date in raising funds for the United Engineering Center; and stated that UET has awarded a $35,925 contract for demolishing existing buildings on the site to the International Wrecking Co. (There is additional information about the Center on another page of this issue.)

Past-President Enoch R. Needles, chairman of the ASCE Member Giving Campaign, presented the general plans for meeting the Society's quota of $800,000 in voluntary contributions. Each Board member will immediately develop a campaign in his respective Zone or District. Mr. Needles' address to the Convention concerning the Center is printed on page 45 of this issue.

Engineers Joint Council

Mr. Needles, who is now serving as president of Engineers Joint Council, called attention to a regional meeting of EJC to be held in Chicago on May 19. He reported plans for the next EJC salary survey and stated that the EJC-ECPD Joint Survey of the Engineering Profession is developing favorably. The cost of the survey, estimated at $1.8 million, is being sought through interested foundations. Mr. Needles spoke optimistically of the prospects for important developments in the coming year in advancing the principle of professional unity.

Travel and Visits

For the record it was reported that since October 1, 1957, members of the Board of Direction had made 54 visits to units of the Society and professional organizations other than their own Board meetings. It was noted that 19 of these visits were made by President Howson. During the same period members of the Headquarters staff made 65 visits, 21 of which were included in the itinerary of E. Stuart Kirkpatrick, Assistant to the Secretary.

Vote of Thanks

The Board directed the Secretary to express its appreciation and thanks to all who contributed to the outstanding success of the Chicago Convention.

Next Board Meeting

The next meeting of the Board is scheduled for June 23-24 at the Multnomah Hotel in Portland, Ore.

Division Doings

Irrigation and Drainage Conference

The humid area east of the Mississippi will be studied by the Irrigation and Drainage Division in its next major conference, which will be held in Memphis, Tenn., September 25-27, in conjunction with a meeting of the Mid-South Section. This important conference will emphasize the growing importance of supplemental irrigation in the humid regions of the country, and will include a tour of interesting irrigation, drainage, and hydraulic projects in the Memphis area. Paul Berg (P.O. Box 737, McCook, Nebr.) has been appointed to work closely with the Sessions Program Committee in lining up good technical papers.

Third National Congress on Applied Mechanics

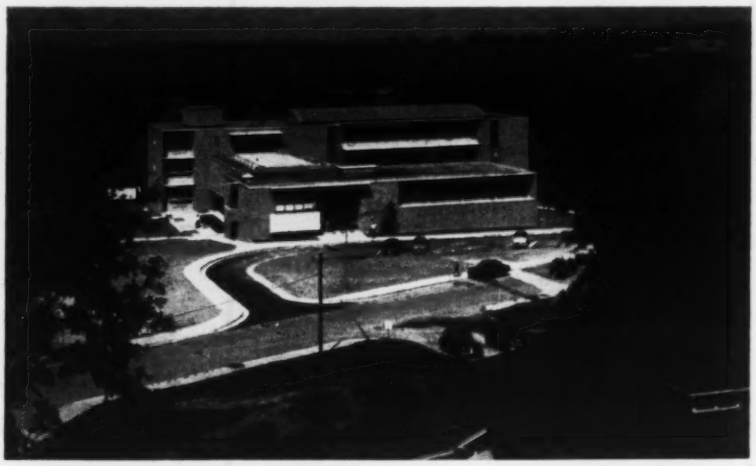
Over 100 papers in applied mechanics will be presented at the Third National Congress on Applied Mechanics, set for Brown University, June 11-14. The congress program, which will be released in May, deals with the mechanics of rigid bodies, mechanics of deformable solids, mechanics of fluids and gases, thermodynamics, and heat transfer. In addition, there will be four general lectures by leading authorities. The Engineering-Mechanics Division is co-sponsor of the congress with Brown University.

To keep the cost of attending the congress to a minimum, an all-inclusive living arrangement is offered. This covers rooms in the new West Quadrangle and all meals from breakfast on Wednesday, June 11, through luncheon on Saturday, June 14, *except* the Thursday night banquet. Rates will be $24 for each of two persons sharing a room, or $30 for a person occupying a single room. Engineers preferring to stay at hotels or motels may lunch in the Brown Refectory at $1.50 per luncheon. The banquet ticket will be $5.00.

Persons registering by June 7 will pay a fee of $4.00; on June 8 the registration fee will go up to $6.00. Checks should be made payable to the Applied Mechanics Congress. Requests for copies of the program and letters concerning advance registration should be addressed to Miss E. M. Addison, Box F, Brown University, Providence, R. I. Registrants should indicate the number of persons in their party, the type of accommodation desired, estimated time of arrival and departure, and need for parking space.

Hydraulics Division Conference

This year the Hydraulics Division will hold its seventh annual conference in Atlanta, Ga., August 20-22. Co-hosts are the Georgia Section and the Georgia Institute of Technology. There will be six half-day technical sessions, devoted to papers on floods and flood control, the hydraulics of highway structures, salt-water intrusion, tidal action, vibration in hydraulic structures, sedimentation, and hydromechanics. One of the program highlights will be a panel discussion on water-use problems and water-rights legislation.



Hydraulics Conference technical sessions will be held in the air-conditioned auditorium of the Architecture Building on the Georgia Tech campus. The program includes a tour of the Institute's Hydraulics Laboratory.

Arrangements for housing the visiting engineers and their families have been made with one of the South's leading hotels, which is within easy walking distance of the Georgia Tech campus. Of interest to members bringing their families is a special rate that will be offered for the occasion. Social events include a banquet preceded by an "ice-breaker" cocktail party. An interesting program is being worked out for the ladies and children, too.

ASCE Joint Manual on Treatment Plant Design

As noted in the March issue, a committee of the Society's Sanitary Engineering Division has been working for several years with the Federation of Sewage and Industrial Wastes Associations in the preparation of a Manual of Practice on Sewage Treatment Plant Design. Members with a professional interest in maintaining the high standards set for ASCE Manuals are invited to review and comment on the proposed Manual. A limited supply of the manuscipt is available for this purpose from Society Headquarters.

The Board of Direction will appreciate receiving any such comment before its final clearance of the project. Review copies may be retained for two weeks, and comments should be mailed to the Joint Committee on the Preparation of a Manual on Sewage Treatment Plant Design at Society Headquarters before May 15.

ASCE QUARTERLY ENGINEERING SALARY INDEX

Consulting Firms

City	Current	Last Quarter
Atlanta	1.11	1.11
Baltimore	1.11	1.11
Boston	1.13	1.13
Chicago	1.30	1.26
Denver	1.19	1.19
Houston	1.12	1.08
Kansas City	1.14	1.14
Los Angeles	1.16	1.16
New York	1.20	1.17
Pittsburgh	0.93	0.93
Portland (Ore.)	1.15	1.15
San Francisco	1.17	1.18
Seattle	1.06	1.07

Highway Departments

Region	Current	Last Quarter
I. New England	0.85	0.88
II. Mid. Atlantic	1.17	1.15
III. Mid. West	1.25	1.24
IV. South	1.07	1.02
V. West	0.97	0.96
VI. Far West	1.15	1.15

Figures are based on salaries in effect as of Nov. 15, 1957. Base figure, the sum of Federal Civil Service, G. S. Grades 5, 7, and 9 for 1956, is $15,930.

First "Seven Wonders" Plaque Presented

Plaque honoring Chicago's sewage disposal system as one of the Seven Civil Engineering Wonders of the United States was presented on February 21. ASCE President Louis R. Howson (left) is making the presentation to Anthony A. Olis, president of the Metropolitan Sanitary District of Greater Chicago. The plant, which has a capacity of 900 mgd of raw sewage, was cited by ASCE as "a herculean task in sanitation." It is the world's largest treatment plant.

ASCE CONVENTIONS

PORTLAND CONVENTION
Portland, Ore.
Multnomah Hotel
June 23-27, 1958

ANNUAL CONVENTION
New York, N. Y.
Hotel Statler
October 13-17, 1958

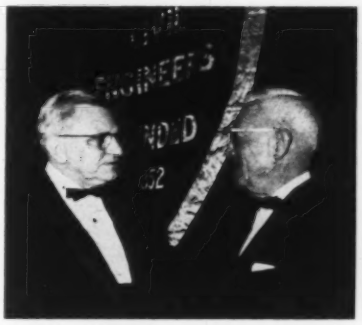
LOS ANGELES CONVENTION
Los Angeles, Calif.
Hotel Statler
February 9-13, 1959

DISTRICT COUNCIL MEETINGS

DISTRICT 9 COUNCIL CONFERENCE
Akron, Ohio
Sheraton-Mayflower
April 18-19, 1958

Local Section Conference
April 17-18

PACIFIC SOUTHWEST COUNCIL CONFERENCE
Phoenix, Ariz.
Westward Ho
April 17-19, 1958



Legislator and engineer joined forces in recent National Capital Section program, with President Louis R. Howson and Tennessee Congressman Clifford Davis the principal speakers. Representative Davis discussed the background of the Corps of Engineers and urged all possible speed in maintaining and carrying out the engineering programs of the Corps. Mr. Howson presented Life Membership certificates to Clark N. Bass, Richard P. Lent, Charles A. Peters, Frank C. Sellnow, and William M. Wiesenberg.

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES: *1958 contest closes May 1, 1958. See 1958 Official Register, page 134; January 1958 issue of CIVIL ENGINEERING, page 77.*

J. WALDO SMITH HYDRAULIC FELLOWSHIP: *1958-1959 award closes May 1, 1958. See Official Register, page 146; January 1958 issue of CIVIL ENGINEERING, page 77.*

LOCAL SECTION MEETINGS

Cleveland—Dinner meeting at the Cleveland Engineering Society Building, April 18 at 6:30 p.m.

Illinois—Weekly luncheon meetings at the Chicago Engineers' Club every Friday at 12 noon.

Los Angeles—General meeting at the Athenaeum, California Institute of Technology, April 9 at 4:30 p.m.; regular meeting of the Junior Member Forum in Room 206 Engineering, California Institute of Technology, April 9 at 5:30 p.m.; informal dinner at Redwood House immediately prior to regular Transportation Group meeting, Room 2 of the Division of Highways Building, April 24 at 7 p.m.; Desert Area Branch, dinner dance, April 11 at Officers' Club, NOTS China Lake at 7 p.m.; San Bernardino-Riverside Counties Branch dinner meeting at Mike's Grill, April 22 at 6:30 p.m.

Metropolitan—Regular meeting in the Engineering Societies' Building, April 16 at 7 p.m. Regular meeting in the Engineering Societies Building, May 21 at 7 p.m.

Mid-South—Spring meeting at the University of Mississippi, University, May 2 and 3.

Nebraska—Dinner meeting at the Memorial Union, University of Nebraska, Lincoln, April 16 at 6:30 p.m.

Philadelphia—Joint meeting with the Trenton Engineers' Club in Trenton, N.J., April 10; annual meeting and installation of officers on May 13; Central Pennsylvania Branch's dinner meeting at Van's Restaurant, Harrisburg, May 14 at 6 p.m.

Tennessee Valley—Chattanooga Branch dinner meeting at Hotel Patten, May 13 at 5:30 p.m.

Texas—Joint spring meeting with Louisiana Section, in Beaumont, May 8-10; Austin Branch dinner meeting at the Engineers and Associates Club on April 17 at 6:30 p.m.

Virginia—Norfolk Branch meeting on the third Monday of every month at 12 noon at the YWCA Cafeteria; Richmond Branch meeting on the first Monday of every month at 12:15 p.m. in the Hot Shoppe Cafeteria; Roanoke Branch meeting second Wednesday of every month at 6:30 p.m. in the S & W Cafeteria.

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

At the **Central Illinois Section's** February meeting talk turned to money, and the members discussed the low average starting salaries for civil engineering graduates compared to rates in the other engineering branches. The members felt that the low scale may reflect the fact that many civil engineering graduates are going into public work. The speaker of the evening was Milo S. Ketchum, partner in Ketchum and Konkel, consulting engineers of Denver, Colo. Mr. Ketchum's topic was "The Status of Structural Engineering in the United States."

Giving the **Cincinnati Section** a taste of things to come, the Society's Student Chapter at the University of Cincinnati was responsible for the speakers at the annual joint meeting of the two groups, in February. There was discussion of courses offered budding engineers at the university and suggestions and remarks concerning the future of civil engineering at the university. Section president Ray Raneri closed the program by mentioning a number of ways the Society is helpful in furthering civil engineers' goals.

The **Cleveland Section** had a busy meeting in January, combining election of new officers, a talk on nuclear developments, and presentation of Life Memberships. The new officers are M. J. Phillips, president; W. B. Hanlon, vice-president; and J. M. Hicks, secretary-treasurer. Recipients of Life Membership certificates were E. J. Affeldt and H. W. Green. Dr. Lauchlin M. Currie, of the Union Carbide Nuclear Company, was featured speaker with a talk, "Nuclear Development for Peacetime Use."

The nominating committee's slate of officers for the **Connecticut Section** was unanimously accepted at the January meeting in Hartford. The new officers are: William G. Weaver, Jr., president; Henry A. Lepper, Jr., vice-president; and Frank J. Zamecnick, secretary-treasurer. Visitors to the dinner meeting were ASCE President Louis R. Howson and E. S. Kirkpatrick, assistant to the Executive Secretary. The Section voted to invite the New England Council to be its guest for the 1959 Regional Conference.

The **Florida Section's** active **Gainesville Branch** has chosen its 1958 slate of officers. They are: C. C. Hill, president; D. A. Sawyer, vice-president; and R. H. Musgrove, secretary-treasurer. A record attendance at the February meeting showed that Dr. Per Brunn's talk on the "General Aspects of Beach Erosion and Aspects of Coastal Engineering in Holland," was of great interest to the members. Doctor Brunn is research professor of engineering mechanics at the University of Florida.

President Carl Kindsvater wielded the gavel at his first meeting with the **Georgia Section** in January. President Kindsvater reviewed the planned activities for the coming year, which include such events of interest as the National Hydraulics Conference in Augusta. Robert N. Clark, of the Tullahoma, Tenn., District of the Corps of Engineers, spoke on "Construction of the Propulsion Wind Tunnel Facility." At their last meeting, members of the **Albany Branch** voted to retain their status as a branch in the Section, and elected R. S. Howard, Jr., president; Nelson Goetze vice-president; and Edward Crawford, secretary-treasurer.

The **Illinois Section** will be under the guiding hand of new president John A. Logan for the year 1958. Backing up Mr. Logan will be his council, consisting of Robert L. Kennedy, vice-president; John G. Hendrickson, Jr., treasurer; and Robert L. Hall, secretary. The Section has recently completed a survey on "Career Satisfactions, Expectations and Separations among Civil Engineers in Illinois." The results of the survey were presented at the ASCE Spring Convention in Chicago. At present, the Section is cooperating with the Chicago Engineering Societies in offering courses on a wide variety of subjects, including engineering writing. For details, write General Education Committee, Chicago Engineering Societies, 84 East Randolph Street, Chicago 1, Ill.

Members of the **Kansas Section** took

ASCE Membership as of March 10, 1958

Members	9,890
Associate Members	13,438
Junior Members	17,254
Affiliates	77
Honorary Members	44
Total	40,703
(March 8, 1957)	39,458)

North Carolina Section member, B. W. Davis, receives Life Membership certificate at the annual meeting of the Section in Raleigh. Shown here at the presentation are: R. E. Fadum, chairman of civil engineering at N.C. State College; Mr. Davis; W. G. Babcock, Section vice-president; and president L. E. Wooten.

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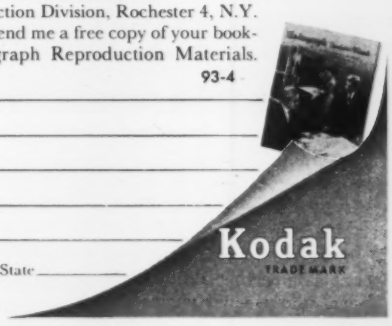

In conversation at annual meeting of Florida Section are R. W. Pride, president of Gainesville (the host) Branch; Louis R. Howson, President of ASCE and featured speaker; and Hubert F. McDonnell, retiring Section president. Mr. Howson presented Life Membership Certificates to Gayle McFadden and Grover G. Dillman. There was a record turnout of 125.

Indiana Governor Harold W. Handley proclaims Engineers' Week, as part of the NSPE salute to the engineering profession. Looking on (left to right) are: Ferdinand Jehle; M. C. Boyer, member of the Indiana Section and chairman of the celebration; Robert Loveland; and Clyde E. Williams, member of the Indiana Section and chairman of the Indiana Engineering Council.

a vicarious trip to the Boy Scouts' World Jamboree at their February meeting when Richard Mistler, an Eagle Scout, showed slides and gave a talk on the Jamboree. Mr. Mistler spoke after dinner and Section business had been put away.

In a do-it-yourself lecture, Thomas H. Nicholl, district manager for the Lincoln Electric Company, explained and demonstrated some of the latest methods in welding structural members at the **Kansas City Section's** January meeting. The Section honored Melvin P. Hatcher, director of the Kansas City (Missouri) Water Department, with a Life Membership certificate in the Society. The Section also voted to give a $500 scholarship to Kansas City engineering students.

Social hours before and after the **Maryland Section's** February meeting bore witness to the prevailing good fellowship as the members gathered to hear Charles C. Zollman discuss "Novel Features in Design and Construction." Mr. Zollman reviewed the evolution which has taken place over a ten-year period in American prestressed concrete techniques.

The Junior Member Forum of the **Metropolitan Section** held a meeting on March 5, to hear Col. M. J. Popper speak on "Management and Organization—Air Force Installation, Base Planning, and Special Engineering Problems." Colonel Popper, who is civil engineer for the New York City Board of Water Supply, discussed factors in airbase planning related to city planning and to large construction projects.

Members of the **Miami Section** are eagerly awaiting the outcome of a very worthwhile engineering education project. The Section, in cooperation with the local chapter of the Florida Engineering Society, has awarded five high school seniors scholarships to attend a surveying course at the University of Miami. The students were chosen for their exceptional scholastic records and their potential for earning a full degree in civil engineering. The results will be announced at a later date.

The **Vicksburg Branch** of the **Mid-South Section** met recently with the Vicksburg Engineers Club to hear a talk by H. G. Dewey, Jr., an engineer with the U.S. Army Engineer District at San Francisco. Mr. Dewey presented the hydrological problems of San Francisco Bay and went on to explain the importance of the San Francisco Bay Model in resolving these problems.

New **Nebraska Section** officers have taken over the reins for a year. They are Kenneth B. Lucas, president; Nathaniel W. Beezley, senior vice-president; Lawrence E. Miller, junior vice-president; and John W. Cramer, director-at-large. There was unanimity in the voting to invite ASCE to hold a national Convention in Omaha in 1961. The Section's **Southwest Branch** has also chosen its new officers: They are Kenneth O. Kauffman, president; Gayle E. Achterberg, vice-president; and Stein J. Freeland, secretary-treasurer.

A lively triangular debate held the attention of members at the recent meeting of the **Northwestern Section.** Keith Miller, Robert Eveby, and Robert Hewitt discussed **"What's Wrong with Plans** and Specifications?" Their debate was followed by a half hour of questions and answers among the members. The Section has approved a petition from its South Dakota members, asking for permission to form a separate South Dakota Section.

Under the watchful eyes of 18 past-presidents of the **Oregon Section,** the 1958 president, Charles Craig, was installed in February. Other new officers are Walter Bushnell, first vice-president; John Merrifield, second vice-president; William Monohan, treasurer; and John Collins, secretary. At the same meeting, Berne M. Howard and Carl F. Thomas were presented Life Memberships.

After 52 years, the **San Francisco Section** finally has a permanent home. B. A. Vallerga, Section secretary, announced that its new headquarters are at Room 302, Atlas Building, 304 Mission Street, San Francisco, Calif.

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BY-LINE WASHINGTON . . . . .

A host of pump-priming public works schemes were unveiled in Washington last month, and it is quite likely that by the time this is read, some gigantic "make-work" programs will have been completed. Congressmen are outdoing each other in a race to introduce bills which would put billions of dollars into construction as a move against rising unemployment.

The President first proposed to launch a $2 billion post office building program, then followed it with stronger stimulants. Among other things, he would lift the highway trust fund limitation on road building, thus starting another $600 million in federal aid toward actual contract awards. Also, he would step up work on some $186 million worth of public works underway already. But Democratic Congressmen have grander ideas in mind. Here are a few:

» Congressman Louis Rabaut wants $1 billion in federal money made available to states and local governments (on a 75-25 matching basis) for public works.

» A whole corps of Senators are associated with a scheme to check the unemployment climb by creating a PWA (Public Works Administration) and endowing it with $500 million to advance for local public works (on a 90-10 matching basis).

» Half the Senate has signed resolutions to accelerate military and civil construction jobs. They want all projects for which funds have already been appropriated, but which were caught in the earlier Eisenhower slow-down, to be accelerated.

» Democrats in the House would like Uncle Sam to lend $2.5 billion to municipalities for sewer, water, and transportation facilities, and other construction.

» Senator Albert Gore has come up with a double-barrelled highway bill which would (1) get the Interstate System back on a 13-year schedule, and (2) boost other federal-aid highway construction funds as an anti-recession move. The Gore Bill is the strongest highway measure this session.

* * *

The latter proposal recognizes the new $40-billion cost estimate tagged into the big Interstate network recently, and authorizes $8.5 billion more needed for this program over the next ten years. Annual authorizations, under Senator Gore's plan, would be jacked up to about $3 billion a year.

Some $450 million more would be authorized for the other federal-aid systems for 1959, and this money would be distributed among the state highway departments at once. (This is in addition to $875 million already apportioned for next year's projects under the 1956 Act.) Because most states could not match such money, which requires "dollar-for-dollar" matching, Senator Gore would "lend" the states this needed $450 million, also. The states could repay the advance over a ten-year period, commencing about five years from now.

(Another significant provision: The money for the so-called ABC roads would be doled out of the general fund, leaving the Highway Trust Fund burdened with only demands for the Interstate System.)

The Senator's ambition has been to get the Interstate program back on the original 13-year completion schedule, but the ABC programs have far greater employment benefits. They require less engineering, so could be started sooner, and not so much of the money is lost in right-of-way costs.

* * *

The Administration does not want to plunge into a huge public works spending program, hopes the recession will break before such schemes are launched. However, a small unit under Gen. John S. Bragdon, Assistant Chief of Engineers, has long been inventorying the nation's needs and reportedly has a $40-billion reservoir of irrigation, flood control, highway and other projects to draw from.

Raising the ceiling over new starts on jobs already authorized is expected to be the next step. Several billion dollars worth of new work could be put under contract in fiscal 1959 if the President chooses, it has been reported. Included are some 576 Bureau of Reclamation and Corps of Engineers jobs worth $1.5 billion.

The pressure to get some construction under way is tremendous. The real nature of the recession is already lost in the shuffle of schemes to cure it. The fact that 1958 is an election year has a great deal to do with the flood of proposals hitting the headlines these days and the cries for action.

* * *

Highway engineers have turned to electronics for the big job involved in *surveying* the National Interstate System. The Bureau of Public Roads is urging state highway departments to explore the possibilities in "Tellurometer," a radar-type system of distance measurement that is amazingly accurate. Reports coming into Washington from trial runs of the electronic technique are causing as much stir here as aerial photography and electronic computers did a couple of years ago. The BPR is pointing out that Virginia is using the system to establish ground controls every few miles down her 1,000 miles of proposed Interstate routes, and is cutting the cost of the job by 46 percent (from $750,000 to $400,000) as well as slashing months off the operation.

* * *

Another bill of interest to self-employed engineers was written in the Senate last month. Senator Malone introduced a measure similar to the familiar Jenkins-Keogh proposal on the House side. Its objective: To allow federal income tax deductions for amounts set aside for retirement. Under the Malone bill, a self-employed engineer could put 10 percent of his income (to $5,000 a year) into a trust account or a retirement insurance policy, tax-free. The benefits would be taxable only when received, after retirement.

Typical finished bridge over dual highway.

How to save $12,000,000 in designing highway bridges

. . . ILLINOIS TOLL HIGHWAY COMMISSION SETS AN IMPRESSIVE "PRESTRESSED" EXAMPLE

The following quotations are taken from a paper, "Prestressed Concrete Bridges for the Illinois Toll Highway," presented at the recent World Conference on Prestressed Concrete by M. E. Bender of Joseph H. Knoerle and Associates, Inc., Baltimore, Md., designers of the bridges.

"Of a total of 289 bridges on the entire project, the superstructures of 224 are carried wholly or in part by prestressed concrete stringers with varying spans up to 107 feet.

"Approximately 448,000 lineal feet of prestressed stringers were required . . .

"A little over 50,000 lineal feet of 36 in. diameter cylindrical prestressed concrete piles will be placed for piers in 90 structures.

". . . estimates of the entire project show that about 45,000 tons of structural steel members were replaced by prestressed concrete at a saving of approximately $4,000,000 over report estimates, and nearly $12,000,000 over steel at prevailing prices.

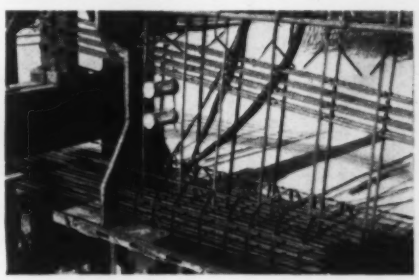
"Comparatively recent improvements in manufacturing . . . were factors in the selection of prestressed concrete members . . . Through these developments it has been possible to hold the cost of prestressed members at reasonable prices in spite of general rises in material prices."

Roebling, right from the beginning, has been active in the research and application of the prestressed principle. Constantly, with the tremendous benefits of prestressed in all kinds of structures becoming more widely known, its acceptance as a structural method is becoming equally widely applied. We will be pleased to discuss with you – and furnish you with literature on – all phases of the prestressed method. An inquiry to Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, will bring a prompt reply.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

Over-all picture of Material Service Corporation casting bed at Algonquin, Illinois. Shows three rows of prestressed girders for Illinois Toll Highway under different stages of construction. Two additional firms that produced prestressed girders are: Lewistown Midwest Division, American-Marietta Company, La Grange, Illinois; and Midwest Prestressed Concrete Company, Rochelle, Illinois.



Consumers Company casting yard at McCook, Illinois, showing details at end of girder during placing of reinforcing steel. Note group of 12 strands sloping up to top of web. These strands are deflected to a point near the bottom of the beam at the third-points of span. The two "tin cans" core holes in the web for transverse steel. Six loops of 7-wire strand provide a lifting hook. The flat bands around the lower group of strands were easier to assemble than reinforcing bars.

NEWS BRIEFS . . .

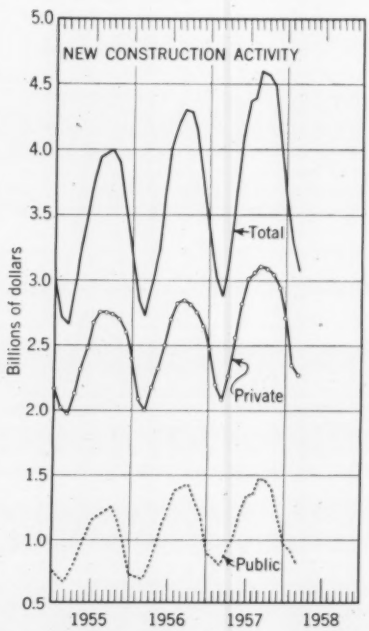
New Construction at Record February High

While new construction activity declined as usual in February, the $3.1 billion of work put in place was slightly above the previous February record set in 1957, according to preliminary joint estimates of the U.S. Departments of Labor and Commerce. Outlays for this February brought the total for the first two months of 1958 to $6.3 billion—an all-time high for the January-February period. Both private and public construction shared in the $142 million gain over the first two months of 1957.

Private spending for new construction this January and February was up slightly from the same 1957 months (by 2 percent) to a record $4.6 billion total. Outlays during the period were at an all-time high for office buildings, hospitals, social and recreational buildings, and for gas and electric power utilities, while church building activity was at the same peak level reported for these months in 1957. At the same time, the dollar value of new housing, which had been below year-earlier levels since the close of 1955, remained virtually the same in the first two months of 1958 as in the comparable period of 1957. The only significant declines in the private sector from last year were in outlays for new industrial plant and store building.

Thus far in 1958 public construction expenditures, totaling $1.7 billion, were 4 percent above last year's all-time high for the January-February period. Most of this gain was in public housing (mainly dwelling units at military installations), which has expanded to the largest dollar volume in six years, recorded in the first two months. Also at a new high for the period were public school building and highway construction—both of which were up 5 percent from a year ago. Sewer construction progressed at the same record rate as in early 1957, and activity on conservation and development was the highest for any January-February period since 1952. However, outlays were significantly less this year than in the first two months of 1957 for new water facilities, military projects, and public industrial plants.

[These monthly estimates are determined primarily by past contract award movements, standard progress patterns, and assumed normal seasonal movements. It should be noted that the estimates of the U.S. Departments of Labor and Commerce are based on current spending. Other sources report on contracts awarded, which currently are down 19 percent in heavy construction compared to the first twelve weeks of 1957.]



February construction outlays, at $3.1 billion, are slightly above previous February record set in 1957.

Work to Start on Niagara Power Job

Plans to start work on the $625,000,000 Niagara power project are announced by the New York State Power Authority, which has obtained a loan of $100,000,000 for temporary financing. The short-term loan was secured from seventeen banks in the state after negotiations carried on while the state's application for license to proceed was before the Federal Power Commission. The license has now been granted. In addition to obtaining the necessary loan, the State Power Authority has formalized letters of intent that will permit the start of construction on work worth more than $160,000,000.

Largest of the awards made to date is the $98,898,101 low-bid contract given the Merritt-Chapman & Scott Corporation for construction of the project's main power plant at Lewiston. Other large contracts have been awarded to the Baldwin-Lima-Hamilton Corporation, which has received $20,686,400 for thirteen turbines for the Lewiston plant: the Westinghouse Electric Corporation, which has a $20,119,910 contract for thirteen generators; and the Allis-Chalmers Manufacturing Company and S. Morgan Smith Company, which will supply twelve hydraulic pump turbines for the Tuscarora plant at $11,291,350.

The Niagara Power Project goes back to 1950, when a new treaty dividing Niagara River waters for power use was made with Canada. Long-drawn-out litigation has prevented starting construction until now. Since 1950, the estimated cost of the project has risen from $385,000,000 to $625,000,000.

San Diego Breaks Ground For Second Aqueduct

Ground-breaking ceremonies marking the start of construction work on the second San Diego Aqueduct took place on January 10 at a point along the aqueduct. First earth was turned by Fred A. Heilbron, chairman of the San Diego County Water Authority and secretary of the board of the Metropolitan Water District. Mr. Heilbron emphasized the need for "Southern California unity" on use of the Colorado River in order to guarantee water for the proposed third aqueduct for San Diego County. He said that importation of Colorado River water had marked a turning point in the development of San Diego County, and increased its assessed value from $250 million to more than $1 billion.

Robert B. Diemer, M.ASCE, chief engineer and general manager of the Metropolitan Water District, outlined the new construction work. The northern portion of the aqueduct will be built to a point about six miles inside the San Diego County line, he stated. In the meantime, the main aqueduct system from the Colorado River to the west portal of the San Jacinto tunnel is being enlarged to its full ultimate delivery capacity of more than a billion gallons daily. The District is also planning to increase the capacity of Lake Mathews, its terminal reservoir.

First water deliveries to San Diego County through the new line are planned for the summer of 1959, when construction will have reached the San Dieguito River below Lake Hodges.

AEC Lets Contract for Large Reactor Shell

The Graver Tank and Manufacturing Co., of Chicago, has been awarded the enclosure shell contract for the $29,100,000 experimental breeder reactor to be built at the Atomic Energy Commission's National Reactor Testing Station near Idaho Falls, Idaho. The contract calls for a 1-in.-thick containment vessel, 80 ft wide and 139 ft high. In addition, Graver Tank will excavate a pit for the enclosure shell and construct a 200,000-gal water-storage tank.

The reactor itself, known officially as Experimental Breeder No. 2, will be built by the AEC's Argonne National Laboratory. It will be used for studies of the economic feasibility of atomic energy. Completion date for the whole project is 1960.

Four-Year Highway Program for Ecuador

This spring Ecuador is launching a $34.5 million highway program. In addition to construction of 330 miles of new road, the four-year program will include improvement of existing roads, organization of a highway department, and establishment of an effective maintenance program. The longest and most important of the new roads will be a 145-mile all-weather link between the capital city of Quito, located in the Andes, and Guayaquil, the largest city in the country and its chief seaport.

The program is getting under way with a loan of $14.5 million from the International Bank for Reconstruction and Development. Additional revenue required will be raised by a gasoline tax and other assessments. The loan was made on the basis of an economic feasibility report prepared for the government of Ecuador by Rader and Associates, of Miami, Fla. The Rader firm will assist the Ecuador Department of Public Works in carrying out its new program, and has opened an office in Quito to facilitate the work.

Steel Production Drops

The January production of raw steel totaled 6,739,000 net tons, according to the preliminary monthly report of the American Iron and Steel Institute. This output was down from the December 1957 production of 7,420,285 tons of ingots and steel for castings. A year ago, in January 1957, the output was 11,008,762 tons.

Steelmaking facilities this January were operated at 56.4 percent of capacity, based on the industry's new (as of January 1, 1958) annual capacity of 140,742,570 net tons.

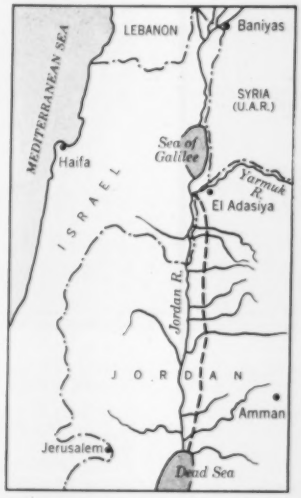
Jordan River Valley Will Be Irrigated

A long-debated plan to irrigate the arid Jordan River Valley will now be carried out. The project, which will irrigate 30,000 acres, involves diverting water from the Yarmuk River by means of a pipeline tunneled through cliffs. The 44-mile irrigation canal, paralleling the Jordan, will extend from the confluence of the Yarmuk and Jordan Rivers to the Dead Sea. Minor irrigation systems already in operation in the area will be tied into the new canal. These systems consist of small sluiceways that bring water from the hills.

The first stage of the canal project is getting under way with a grant of $1,140,000 just released by the United States. The cost of the entire project will be in the neighborhood of $12,750,000. The Jordan government expects to be reimbursed in ten years by levying higher taxes on the irrigated land, most of which is privately owned. It is estimated that the new project will increase the country's annual income by at least $7,000,000.

The Jordan Valley has rich soil and a mild climate and needs only moisture to produce several crops a year. The annual rainfall of about 7 in. a year permits only one crop a year at present.

Preliminary surveys for the Jordan irrigation project have been completed by two United States companies—Michael Baker, Jr. Inc., of Rochester, Pa., and the Harza Engineering Company, of Chicago.



Broken line indicates route of proposed Jordan Valley canal.

Navy Dedicates Its Biggest Shore Establishment

This specially designed pier providing 20 acres of deck area—largest in the United States Naval Shore Establishment—was dedicated by U. S. Senator Theodore F. Green at the Davisville, R. I., Seabee Base on March 6. The rectangular-shaped pier, averaging 1,450 ft long and 650 ft wide, adds 1,900 ft of berthing space to the Center and almost doubles its docking capacity. Its perimeter consists of an L-shaped arrangement of 56 steel sheetpile cells—each 52½ ft by 37 ft— and a 1,460-ft-long riprapped granite earth dike. The occasion also marked two naval milestones —the 16th birthday of the Seabees and the 91st anniversary of the Civil Engineer Corps. Jenks & Ballou, of Providence, R. I., were the consulting engineers, and Merritt-Chapman & Scott, the contractors.

Projects of Florida Builder Baffle Engineers

CARROLL LAKE
New York, N. Y.

Do-it-yourself jobs usually take little if any engineering ability or knowledge. There is one however, running many tons in weight, which a frail 85-pound man did by himself. How he did it is still—years after his death—baffling engineers from many lands who come to see his projects. To solve his secret would be to solve the engineering secrets of the builders of the Pyramids.

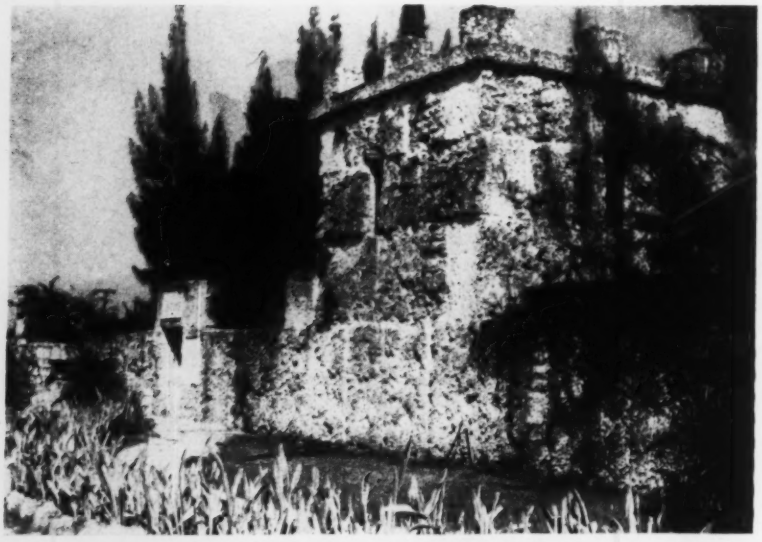
The mysterious builder was Ed Leedskalnin, a Latvian immigrant, who died in 1951. His projects, built over a 33-year period, include a coral castle, many pieces of stone furniture, a wall, and a ten-ton and a three-ton rock gate, which may be seen on U. S. 1 25 miles south of Miami, Fla. He began to build in 1919—first the wall and gate, then a house. From under his own acres he quarried the solid coral rock used in his projects. He bored holes in the rock and then cut it out in large blocks, probably with wires. Through a process known only to himself, he lifted the blocks to the surface—cut to the size and shape he wanted. The scarcity of stone chips shows he made no false moves and no mistakes. He did little smoothing or resurfacing.

Leedskalnin's most amazing feat was hoisting the huge blocks, weighing from 4 to 30 tons, into place. With only the crudest of hoists made by himself from handhewn timbers, he got the blocks in position, some of them over 20 ft above the ground. He fitted these blocks together with the sureness of a jeweler working on intricate pieces. The seams are perfect, without cement or mortar. Leedskalnin's tower home, which he called his "Coral Castle," was made up of 243 tons of rock blocks. Each block averaged nine tons.

He surrounded his three acres with an 8-ft-high wall, nearly 3 ft thick. It was in this wall that he built his masterpiece, the two pivoted and balanced, rock gates, which are perhaps the most mystifying of his feats. One of the gates consists of a ten-ton block of coral rock, 3 ft thick, set on edge and so perfectly balanced that the gate swings open or closes at the touch of a child's finger. It is almost 7 ft high and 5 ft wide. The construction of the gates alone speaks volumes for the uncanny accuracy of Leedskalnin's engineering knowledge. He had to know the pivot points exactly —without guesswork or trial and error— and to hang the gates in perfect balance. The fact that the gates are of porous coral and uneven in density increased the difficulty of figuring the balance points.

One of Leedskalnin's eccentricities was that he did much of his work in the dead of night, with only a small lantern for light. Another characteristic was that he always stopped working when anyone came around. Not only did he keep his methods strictly to himself, he made no written notes or blueprints or drawings.

Rock gate, consisting of ten-ton block of coral rock set on end, is so perfectly balanced that it swings open or closes at the touch of a child's finger.



This tower home, called the "Coral Castle," is made up of 243 tons of rock blocks. Massive rock wall and pivoted gate are also visible.

American Firms Awarded Persian Port Contract

Two United States firms have been given a $23,000,000 contract for reconstruction of port facilities in Kuwait, an oil-rich country on the Persian Gulf. They are the Pomeroy Construction Corporation and the Hawaiian Dredging and Construction Company, Ltd. The Pomeroy concern is a wholly-owned foreign subsidiary of J. H. Pomeroy & Co., Inc., which designed the new Kuwait port structures. The contract was negotiated with Sheikh Fahd al-Salim al-Sabah, president of the Kuwait Board of Public Works.

The Kuwait Project will include 3,700 ft of wharves to accommodate large sea-going vessels with drafts up to 37 ft. Equipment is being assembled for the job in West Coast ports.

Long Beach Starts Work on Civic Center

Long Beach, Calif., will modernize and expand its Civic Center. The $30,000,000 improvement program was launched in March with award of a contract to the Twaits-Wittenberg Co., Los Angeles constructors and engineers, for construction of a $3,750,000 Public Safety Building. This key building will be a six-story structure of reinforced concrete and structural steel, with shop-fabricated curtain walls on two sides. The ground floor will feature wall setbacks with exterior free-standing columns.

The building will include a jail, which will be reached by special elevators and vehicular ramps to keep public and prisoner traffic separate.

Work to Start on Dez Dam in Iran

Completion of contract arrangements for preliminary work on the Dez Dam project in southwestern Iran is announced by the Development and Resources Corporation. The 620-ft-high dam—the first in a projected series of multi-purpose river control structures in the Khuzestan region of Iran—was recommended by the corporation last fall in a report to the Iranian Government's Plan Organization (November 1957 issue, page 100). The managing director of the Plan Organization is Abol-Hassan Ebtehaj. The Development and Resources Corporation is headed by David E. Lilienthal and Gordon R. Clapp, both former chairmen of the Tennessee Valley Authority.

Morrison-Knudsen-International Contractors, Inc., of San Francisco, is starting work on the access road to the damsite, located in a deep mountain canyon 150 miles north of the Persian Gulf. This road, which is scheduled for completion in 1959, follows a tortuous $2\frac{1}{2}$-mile route down the face of the canyon wall. The Morrison-Knudsen contract, totalling over $4,000,000, also includes erection of the construction camp for the main contractor.

Electroconsult, of Milan, Italy, will design the dam under the direction of three consultants—A. A. Meyer, Dr. Carlo Semenza, and Prof. Guido Oberti, all members of ASCE. Design of the powerhouse and other electrical features was begun in New York last December under direction of the Development and Resources Corporation.

The ultimate power capacity of the project will be 520,000 kw, of which 130,000 kw will be available by 1962. The project will also store enough water to irrigate 375,000 acres of land in the Khuzestan plain. A detailed irrigation plan is being worked out by the Dutch firm of Nederlandsche Heidemaatschappij who began field work last October under contract to the Development and Resources Corporation.

Stone & Webster Expand

In a move to broaden its activities in the nuclear field, the Stone & Webster Engineering Corporation, of Boston, has acquired Associated Nucleonics, Inc., of Garden City, N. Y. The Garden City firm, formerly known as Walter Kidde Nuclear Laboratories, Inc., was purchased from Walter Kidde & Company, and Walter Kidde Constructors, Inc., which formed the research and development unit in 1952.

Stone & Webster is currently working on the Yankee Atomic Power Plant at Rowe, Mass.; the Carolinas-Virginia reactor project at Charlotte, N. C.; and the 25-billion-electron-volt synchroton at the Brookhaven National Laboratory. As a subcontractor to Westinghouse, it also designed and assisted in the construction of the general facilities at the Shippingport atomic plant.

Information Center for Engineers Visiting Europe

This modern exhibition building on the outskirts of Rotterdam is a non-profit, international information and research center for engineers and builders. Called the Foundation Bouwcentrum, the building includes extensive exhibit areas for display of new construction methods and building materials, plus a large technical library with some 500 publications in the major languages. Engineers in Brussels this summer for the World's Fair will find a trip to the Bouwcentrum highly rewarding. There is daily helicopter service between Brussels and Rotterdam, which is one of the largest and most modern ports in Europe.

Work at Priest Rapids Dam Ahead of Schedule

Work continues ahead of schedule at Priest Rapids Dam, which is being built on the Columbia River in central Washington. The project is now (late February) more than one-third complete. In upper left area—protected from the river by huge cofferdams—the first 11 of the dam's 22 spillway bays are under construction. Water-intake structures of the 1,025-ft-long powerhouse are shown in the center, and the large structure at the right will house the left-bank facilities for fish passage. In the right foreground is a conveyor belt for moving aggregate to the concrete batch plant. The Merritt-Chapman & Scott Corporation, of New York, is building the dam and hydroelectric power plant, under a $92,000,000 contract, for the Public Utility District of Grant County. The consulting engineers are the Harza Engineering Company of Chicago.

Tomorrow's Highways Previewed at ACI Convention

Will the pavements we design and build today be adequate for 1980 traffic? This was one of the questions dominating the 54th annual meeting of the American Concrete Institute, which took place in Chicago concurrently with the Society's Convention, the last week in February. A number of the technical and social events of the week were joint affairs with ASCE.

One complete session of the four-day program was devoted to previewing the highways of the future on the basis of present design requirements, construction practices, and experimental work currently underway with concrete pavements. The session emphasized that engineers must be looking ahead twenty years to the time when the National Highway Program will be finished.

All signs, it was reported, point to an increase in the number of continuously reinforced concrete pavements that will be constructed. In addition, the program revealed that prestressed concrete has also been found feasible for pavement slabs in experimental projects. It is the consensus that some modification or combination of these types of construction may well be the design of the future.

One of the major problems confronting pavement designers is the tendency in certain areas to increase permissible axle loads for commercial vehicles. At the present time the range is from 18,000 to 22,400 lb. However, the number of permits issued for operation of heavy hauling equipment is increasing rapidly each year, with the result that loads as high as 35,000 lb on multiple-wheel axles are becoming common. The frequency of axle-load applications is another factor to be coped with in view of the constant increase in traffic.

The engineers were told that, with the trend toward wider highways, they are going to have to get used to designing 12- rather than 11-ft lanes. And most important, they are going to have to do something about the rapidity with which concrete as well as other types of pavement becomes slippery when wet. The solution may require an entirely new concept in concrete pavement mix design, particularly for the top part of the slab.

The session was sponsored by ACI Committee 325—Structural Design of Concrete Pavements for Highways and Airports—under the chairmanship of E. A. Finney, director of the Highway Research Laboratory of the Michigan State Highway Department. The reports of three subcommittees of Committee 325 were featured. Subcommittee 6, under the chairmanship of J. A. Bishop, of the Navy's Civil Engineering Research and Evaluation Laboratories at Port Hueneme, reported on prestressed concrete pavements; Subcommittee 7, headed by J. D. Lindsay, of the Illinois Division of Highways, reviewed the use of continuous reinforcement in highway pavements; and Subcommittee 8, under L. M. Arms, of the Portland Cement Association, reported on the design of concrete overlays for concrete pavements.

New Standards Adopted

Four new standards of recommended practice for the concrete industry were adopted during the meeting. Two of them affect pavement design and construction. The third standard is on precast floor and roof units, and the other is a test procedure to determine the relative bond value of reinforcing bars.

Douglas McHenry
President of the ACI

Before adoption of the standards is official, they must go to the ACI membership for ratification by letter ballot.

New Officers Elected

Douglas McHenry, M.ASCE, director of development for the Portland Cement Association, Chicago, took office as president during the meeting, succeeding Walter H. Price, M.ASCE, head of the Bureau of Reclamation's engineering laboratory in Denver. Joseph W. Kelly, M.ASCE, professor of civil engineering at the University of California, was elected vice-president for a two-year term.

Awards Presented

Winners of the Institute's 1958 awards were announced during the meeting. Five ASCE members were among those honored. They were Herbert J. Gilkey, who received the Turner Award for "notable achievement" in the concrete industry; Arsham Amirikian, who was given the Lindau Award for "his continued devotion to the improvement of design practices"; R. E. Copeland, who was awarded the Wason Medal for the "most meritorious paper"; and Donald S. Wild, winner (with James S. Minges) of the Construction Practice Award for a paper entitled "Six Stories of Prestressed Slabs Erected by Lift-Slab Methods."

Honorary membership in the ACI was conferred on three engineers in recognition of outstanding service in the field of concrete or the work of the institute. They are Eugene Freyssinet, of Paris; Douglas E. Parsons, M.ASCE, chief of the Building Technology Division of the National Bureau of Standards, Washington; and Stanton Walker, M.ASCE, director of engineering of the National Sand and Gravel Association, Washington.

Access Highway for Bethlehem Steel Co.

A major portion of the Bethlehem Steel Company's $3,500,000 access road system for its Sparrows Point (Md.) plant was recently opened to traffic. The completed part of the work includes 1.2 miles of four-lane highway, 3.8 miles of two-and three-lane highway, four interchanges with seven grade separations, and a 25,000-sq yd parking area. The seven fixed-span bridges, ranging in length from 114 to 263 ft, are built on pile foundations. The entire area is underlain with a 40-ft silt layer and the embankments were surcharged to accelerate consolidation.

The new network, which will supplement an existing access road system in handling heavy employee traffic loads, was designed by the Baltimore consulting firm of Whitman, Requardt and Associates. It connects Maryland State Route 151 on the east with the Bear Creek Toll Bridge into Dundalk. Plans for expansion call for a connection to the three-mile Peninsular Expressway, now under preliminary design.

Whitman, Requardt and Associates supervised the construction of the new access road, which was built by C. J. Lagenfelder and Son, Inc., of Baltimore.

Workers Win Half Million In Collapse of Crane

Two structural steel workers were recently awarded $500,000 damages by a Brooklyn Supreme Court jury for injuries sustained in the collapse of a crane last May on a Queens College construction project. One worker won $265,000 for two broken legs, and the other $235,000 for a broken back. Both were hospitalized for five months and must still use crutches. The verdict—against the Dreier Structural Steel Company—was said to be the largest ever returned by a jury in New York State.

The accident occurred when a 140-ft boom lifting a ten-ton steel girder collapsed letting the girder crash on a 20-ft platform. The men, who were on the platform, were thrown to the ground by the impact.

Laying one course of the 7½-inch Texaco Asphaltic Concrete foundation on US Route 301 in Sussex County, Va.

Contractor
Adams Construction Company
Roanoke, Va.

What type Asphalt pavement for Interstate Highways?

Virginia supplies one answer to that question on the new northbound lane under construction on 11 miles of US Route 301. The most heavily traveled north-south truck route across Virginia, US-301 is part of the new Interstate Highway System.

The foundation for this important project consists of a 7½-inch thickness of coarse-graded, plant-mixed Texaco Asphaltic Concrete, laid in three courses on an 8-inch subbase of selected borrow material. The wearing surface is plant-mixed Texaco Sand Asphalt, laid to a compacted thickness of 1½ inches.

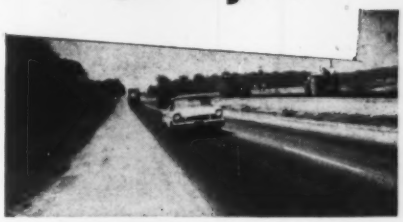
This is one of a number of heavy-duty asphalt pavement designs suitable for Interstate Highway Traffic.

Asphalt highways are equal in durability, lower in average upkeep cost, superior in riding quality and *cost substantially less* than rigid highways having the same load-bearing capacity. The important savings afforded by Asphalt become more and more vital to highway officials and motorists, as a result of currently rising road building costs.

Helpful information on methods and materials recommended for all types of Asphalt construction for highways and streets is provided in two free Texaco booklets. Copies may be obtained without obligation by writing our nearest office.

ENGINEERING · RESEARCH · EDUCATION · THE ASPHALT INSTITUTE

MEMBER



The existing asphalt pavement on US-301 will be the southbound lane of the new, divided Interstate Highway.

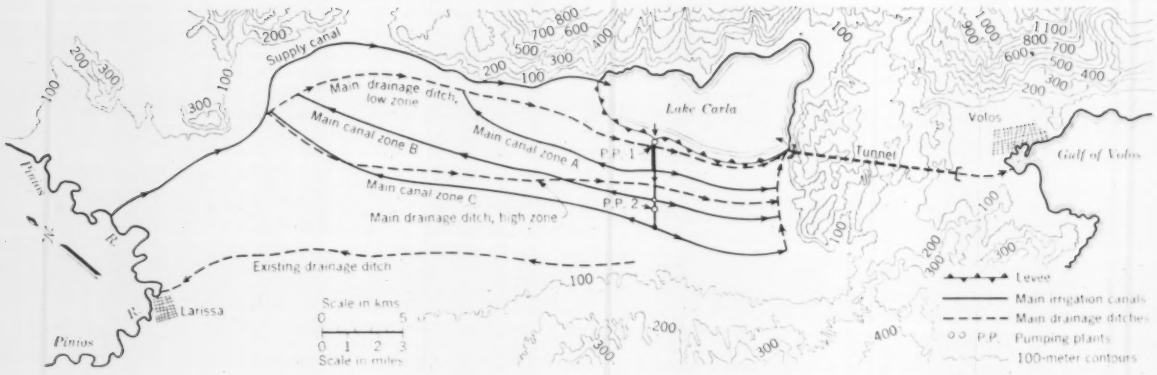
Section of the Plant-Mixed Texaco Sand-Asphalt wearing surface on new, northbound lane of US-301.

THE TEXAS COMPANY, Asphalt Sales Div., 135 E. 42nd Street, New York City 17

Boston 16 • Chicago 4 • Denver 1 • Houston 1 • Jacksonville 2 • Minneapolis 3 • Philadelphia 2 • Richmond 19

TEXACO

TEXACO ASPHALT



Grecian Lake Area Reclaimed for Agriculture

GEORGE E. PAPADOPOULOS, M. ASCE, Chief, Hydraulic Engineering Division, Ministry of Agriculture, Athens, Greece

It is important to Greece's national economy to improve the country's agriculture. While the rural population of Greece is 65 percent of the total population, the rural income is but 38 percent of the income of the whole state. One interesting project in the country's intensive program to develop soil and water resources through reclamation and irrigation is the 65,000-acre Lake Carla Project located in Thessaly in central Greece.

Lake Carla lies in the lowest part of a closed basin at an elevation of about 130 ft above sea level and separated from the Gulf of Volos, 9 miles away, by a range of limestone mountains, as shown in Fig. 1 (see above). The only outlet from the lake is through natural passages in the carstic limestone called "catavothres."

With an average rainfall of 19.7 in. over a watershed of 415 sq miles tributary to Lake Carla and a runoff coefficient of 0.13, the inflow to the lake is much greater than the capacity of the catavothres to carry it away. The lake level fluctuates widely from season to season. In 1956 it covered 17,500 acres more than in the preceding five-year period. Agricultural land was drowned out, and even higher lands became too wet and too alkaline to use.

The project now under construction is expected to provide flood protection for the land bordering the lake; to secure normal drainage from the benefitted area; and to make the area irrigable.

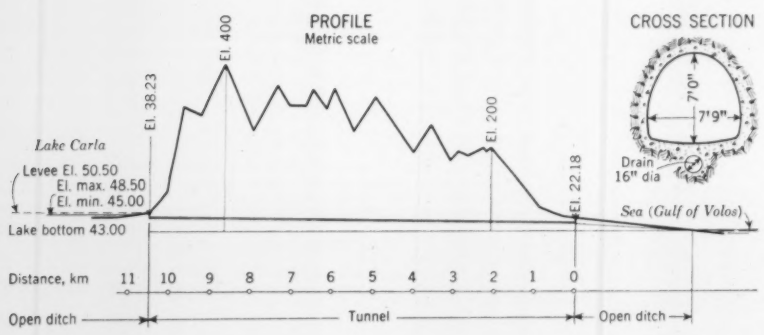
Since Lake Carla is the only local source of water available, it must do double duty—that is, serve as both an irrigation reservoir and a drainage reservoir. The plan is to construct an 18-ft-high levee 9 miles long along the south shore of the lake. The reservoir thus created has a capacity of 220,000 acre-ft divided as follows: dead storage, 2,000 acre-ft; irrigation storage, including evaporation and seepage losses, 172,000 acre-ft; and for flood storage, 36,000 acre-ft. Lake Carla already is too salty for irrigation use (3 to 3½ percent soluble salts). Diversion of Pinios River water during the winter months to Lake Carla will supply fresh water. During summer months the total flow of the river (about 210 cfs) is used to irrigate lands adjacent to the river. The supply canal is 26 miles long with an average gradient of 0.0003 and a capacity of 350 cfs.

Drainage water, too alkaline to return to the lake, drains out of the basin through a 6½-mile tunnel through the mountain and discharges by an open ditch, 2 miles long, to the Gulf of Volos. The concrete-lined tunnel, shown in profile and cross section in Fig. 2 (below) has a capacity of 250 cfs. Not only does return drainage from the land drain out through the tunnel, but it also provides the spillway for the new lake that will prevent flood flows from overtopping the levee.

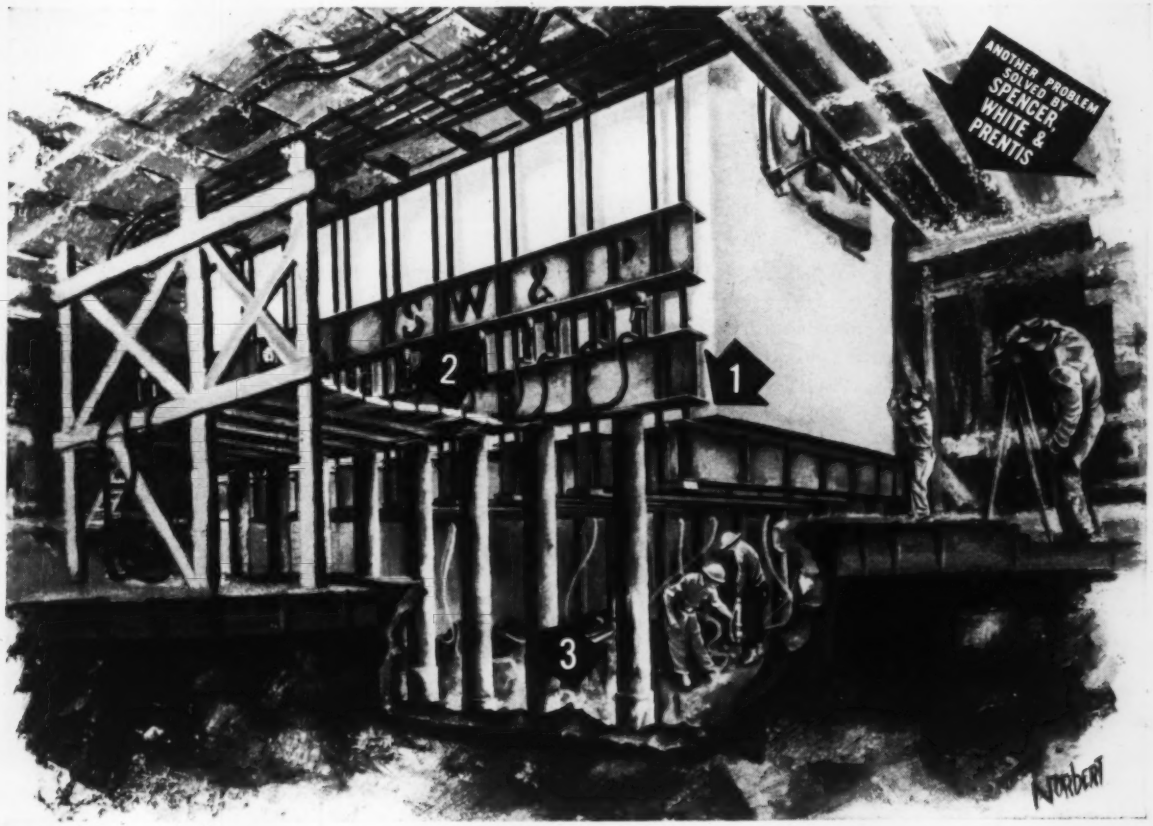
All the land to be irrigated lies above normal lake level. It is divided into three zones as shown in Fig. 1, each supplied by pumps having a combined capacity of 750 cfs. For drainage purposes the irrigated area is divided into a high zone which can drain to the tunnel, and a low zone which must be pumped to the lake.

The project is already under construction. Tunnel driving from the downstream end was begun early in 1957 by the Greek construction company, AEGEK Ltd., and progressed a half-mile through alluvial material before reaching sound rock. The total estimated cost of the project is $6.6 million, with the ratio of cost to benefit evaluated at 1:1.57. Yearly charges per irrigated acre, including project cost, amortization, operation, and maintenance, will reach about $26 per acre. The corresponding increase in annual income per acre, it is estimated, will approximate $40 per acre.

Because of the importance of this work its supervision has been assumed by a special interdepartmental joint committee consisting of representatives of the departments of Public Works, Agriculture, and Coordination.



600-TON VAULT LOWERED ON STEEL RODS
through unique use of hydraulic jacks



Project: Modernizing of First National City Bank, Wall Street, New York City
Architects: McKim, Mead & White, New York City *Engineers: Purdy & Henderson Associates, New York City*
General Contractor: Starrett Brothers & Eken, New York City

1. Needle beams and threaded steel rods carry vault load.
2. As jacks retract, lowering top carriage beam, the suspended vault descends 10 inches.
3. New pipe piles (replacing old wood piles) provide temporary lowering support and permanent foundation.

As part of the bank's modernization, it was desired to lower a 600-ton vault 13 ft. into a basement pit — to do this without interrupting normal banking activities. The conventional method — that of using jacks directly under the vault — would have incurred great risk at considerably higher costs.

The above sketch shows the unique plan devised, and successfully carried through, by Spencer, White & Prentis. Its chief features were:

Maximum certainty. There was no shifting of load or support—the heavy vault was securely held from above throughout the entire lowering operation.

Novel method. The hydraulic jacks were used "in reverse." During the periods when the top carriage beams were holding the load delivered through the steel rods, the retraction of the jacks lowered the massive 2-story vault, 10 inches at a time. (The bottom carriage beams, resting on the piles, remained stationary throughout).

Lowering tolerance. The vault, suspended on 32 steel rods, was maintained level so that delicately balanced vault doors would not go out of adjustment.

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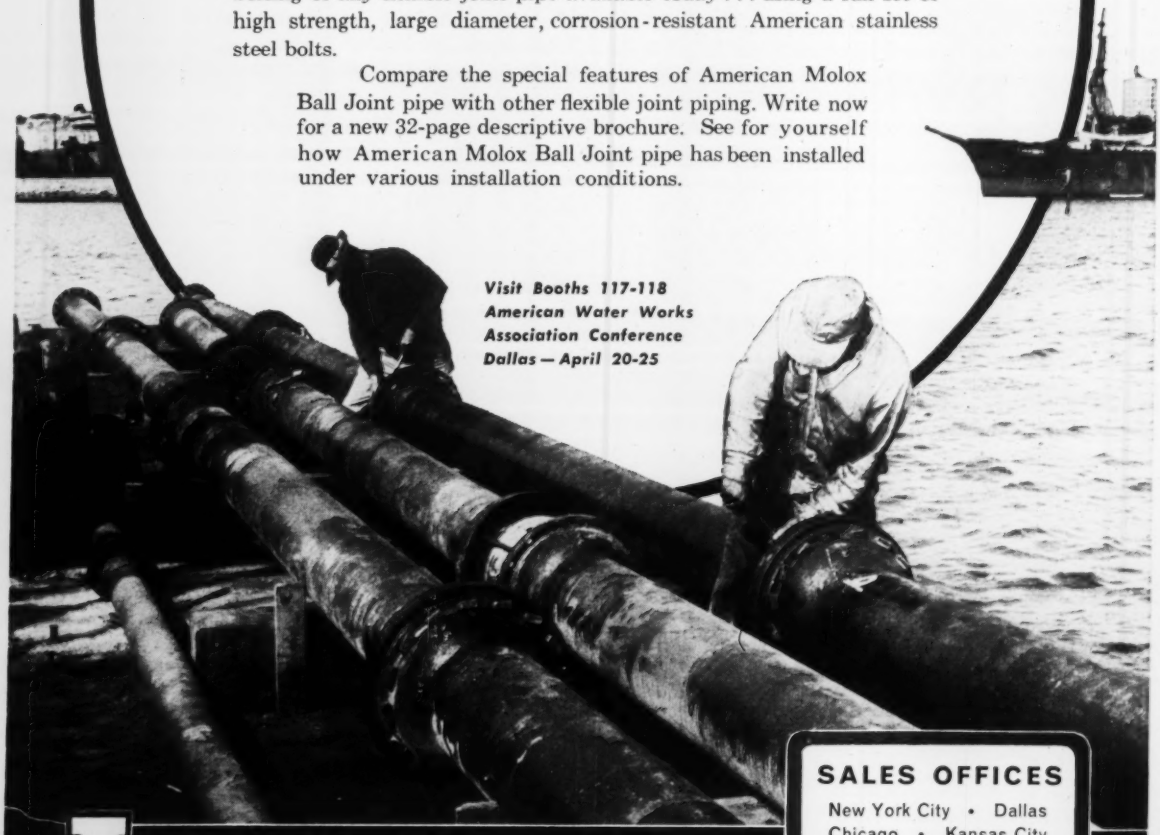

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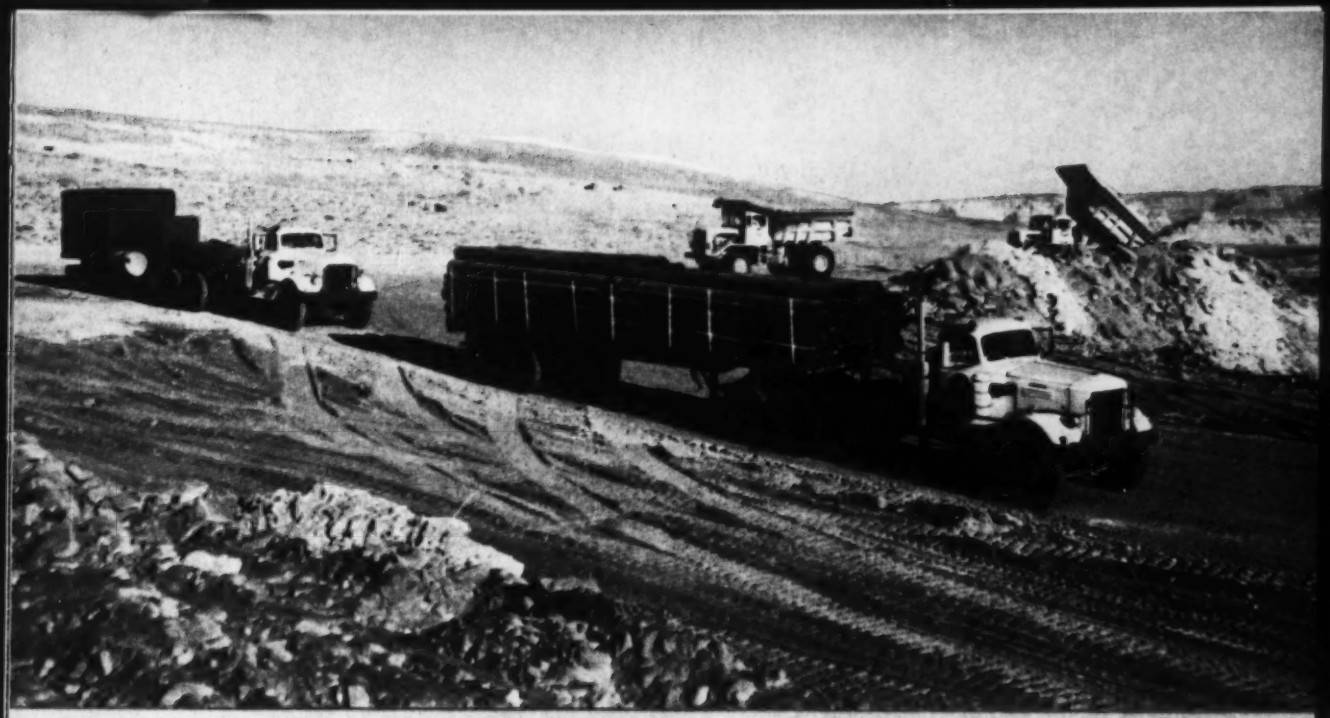
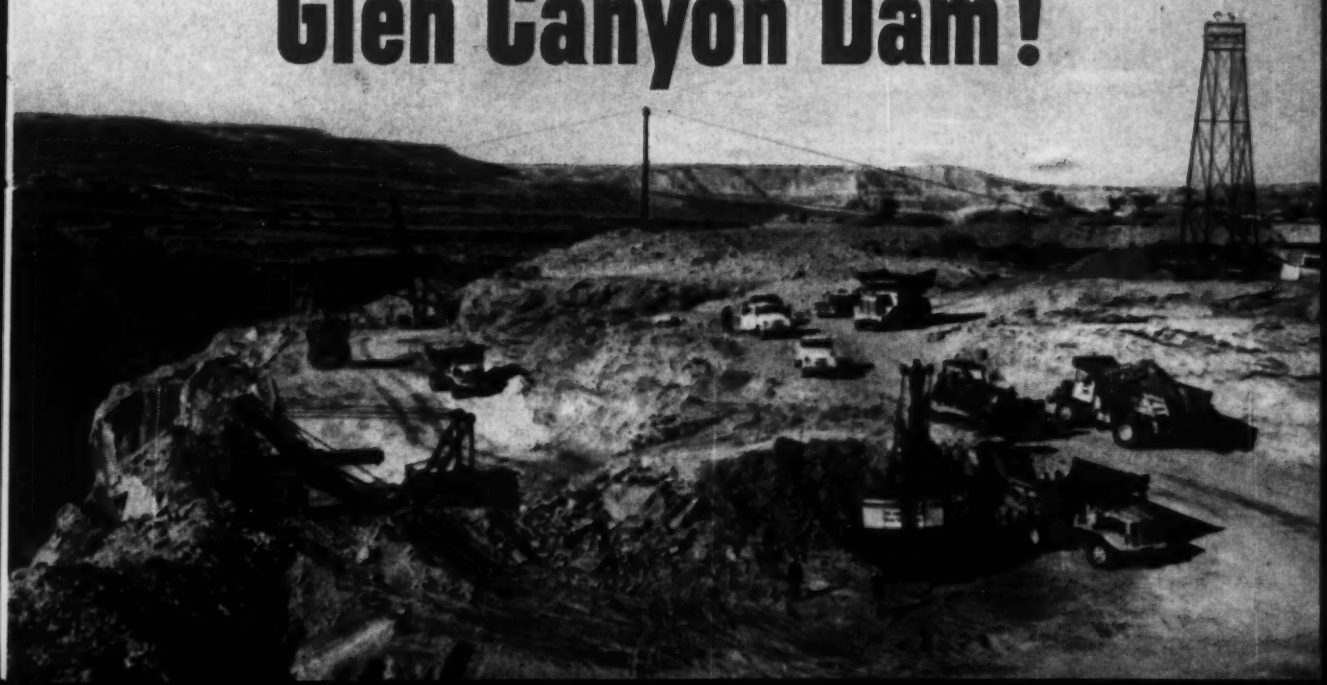
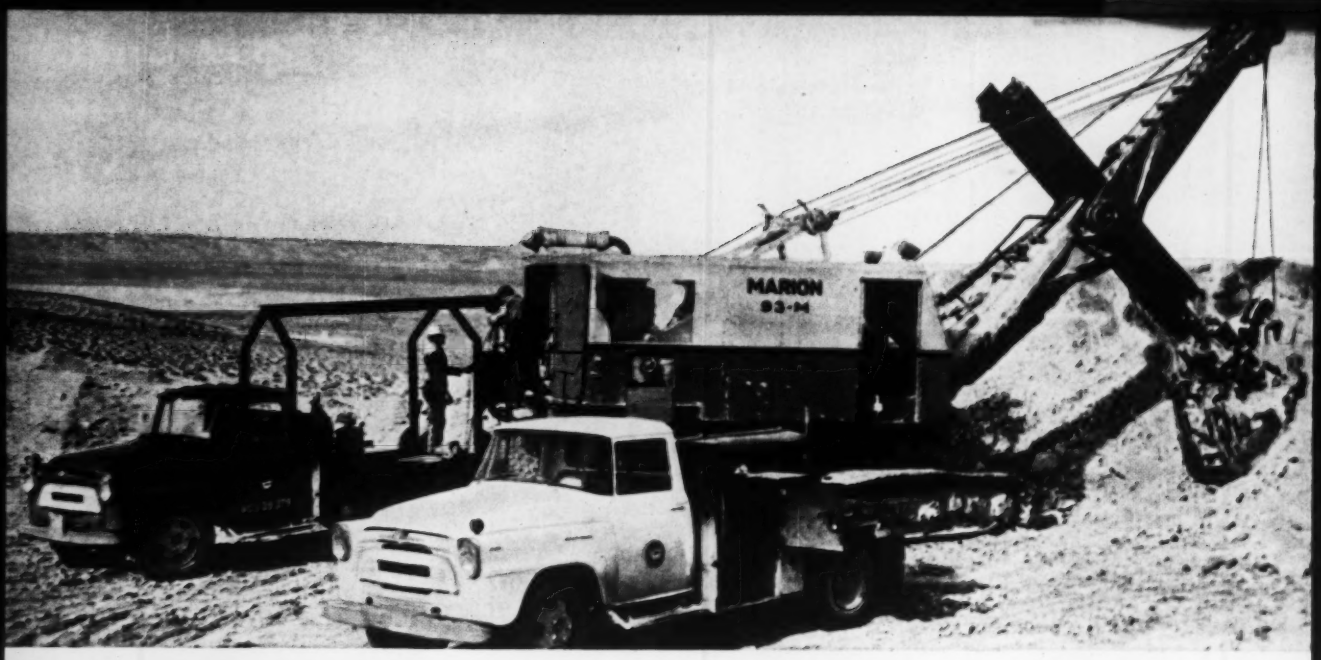


Merritt-Chapman & Scott mobilizes International® fleet to build colossal Glen Canyon Dam!





Noon time is inspection time as Merritt maintenance men, using International welder and shop trucks, roll up to Marion power shovel for fast, on-the-job service.

$108 million contract crawlers, haulers,

"95" Payhauler fleets keep busy on both sides of the 700-foot-deep canyon. These three units are hauling shovel-loaded rock from spillway excavation on the huge Glen Canyon Dam project.

Carving off a section of Beehive Rock to enlarge a working area—TD-24 Planet Power steering keeps the blade full, rounding the curve; moves bonus yardage, every pass. Payhaulers on road below are moving sandstone to a fill.

rolls on schedule with International® trucks and service!

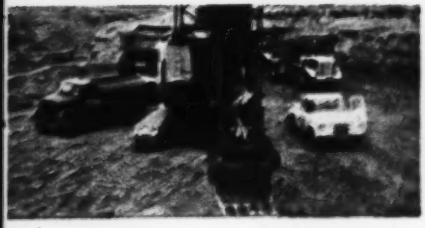
MERRITT-CHAPMAN & SCOTT CORPORATION is shooting to complete its $108,000,000 Glen Canyon Dam contract—biggest competitively bid job ever awarded to a single contractor—well ahead of the specified seven-year limit. A big fleet of International equipment helps keep this huge Bureau of Reclamation project on the Colorado River in Northern Arizona rolling at record pace.

Planet Power-steered TD-24 crawlers prove the worth of full-time live power on both tracks—blading bonus loads 'round the curves. Grade-beating "95's" high-balling rock show why a load-and-road-matched Payhauler® fleet—bonus-powered with turbo-charged diesel engines—belong on this tough, high-altitude job. International trucks are here, there, and everywhere—handling a multitude of different material, equipment, and personnel-carrying assignments.

And complete International parts and service is minutes close to insure high performance availability of every International machine.

8-passenger International Travelall, with hill-climbing four-wheel-drive, transports engineers and surveying equipment over rough terrain right to the dam site.

Here a rugged International truck with boom rig is used by electrical linemen to set up important transmission lines on the east side of the Colorado River.

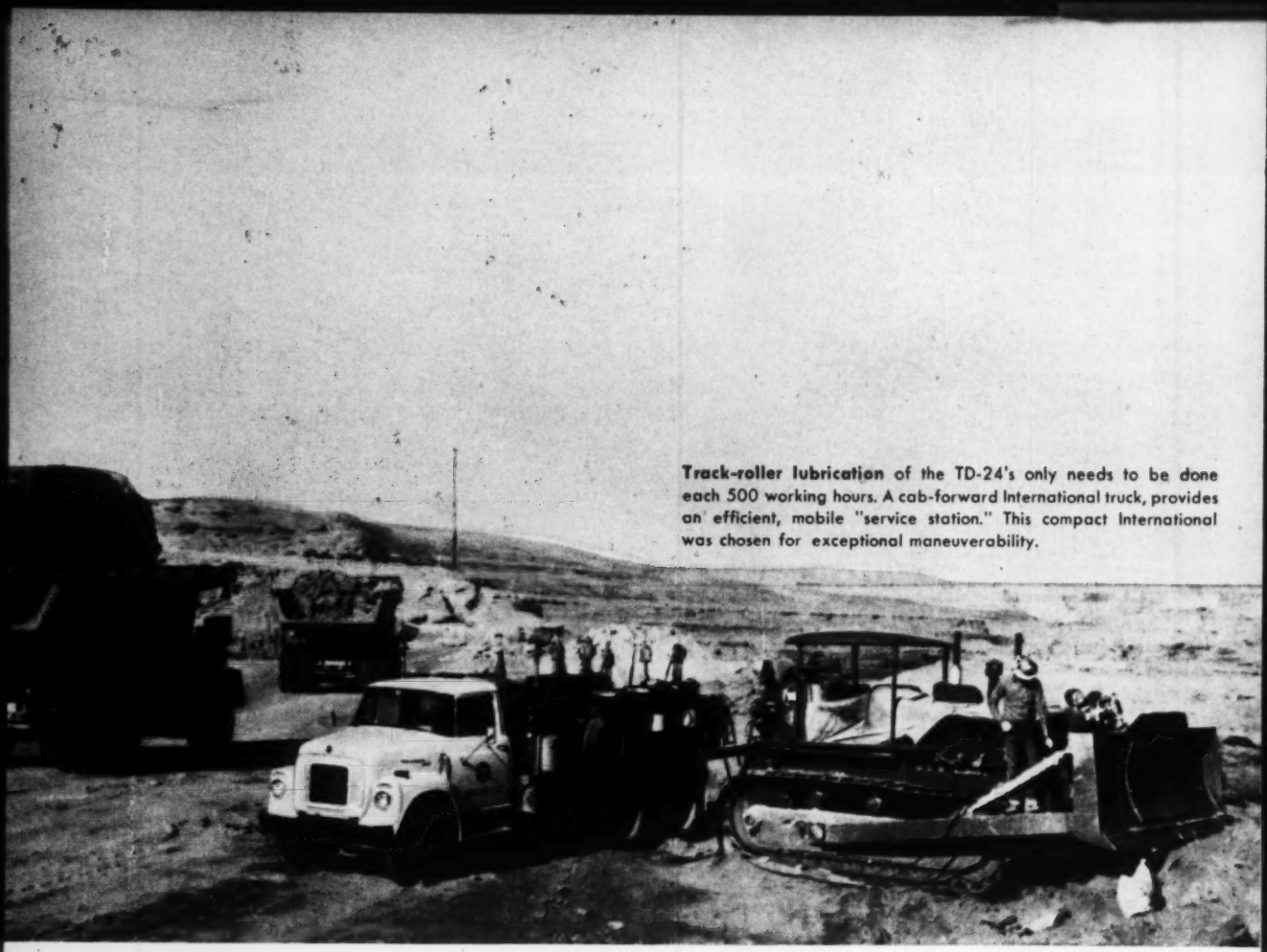


On-the-spot maintenance. International shop truck moves in as shovel takes "fuel break" from International cab-forward tanker.

Big capacity. Six-wheel heavy-duty International truck with 5,000-gallon tank sprinkles water for compaction of road base.

Ready for any emergency. Merritt medical crews use International Travelall ambulances, complete with oxygen and first aid equipment, to provide mobile first aid. One stands by on each side of the river.

Making ready for power. Conventional International truck with engine-driven auger sinks holes for transmission lines.



Track-roller lubrication of the TD-24's only needs to be done each 500 working hours. A cab-forward International truck, provides an efficient, mobile "service station." This compact International was chosen for exceptional maneuverability.

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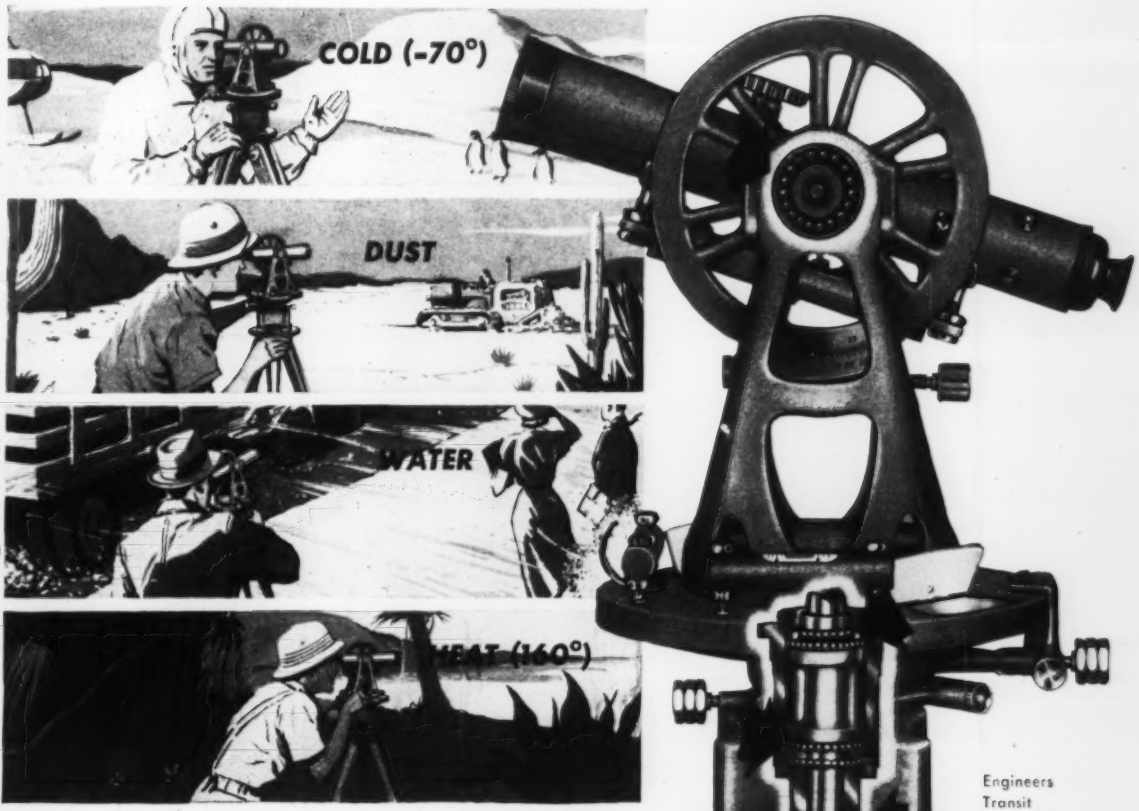

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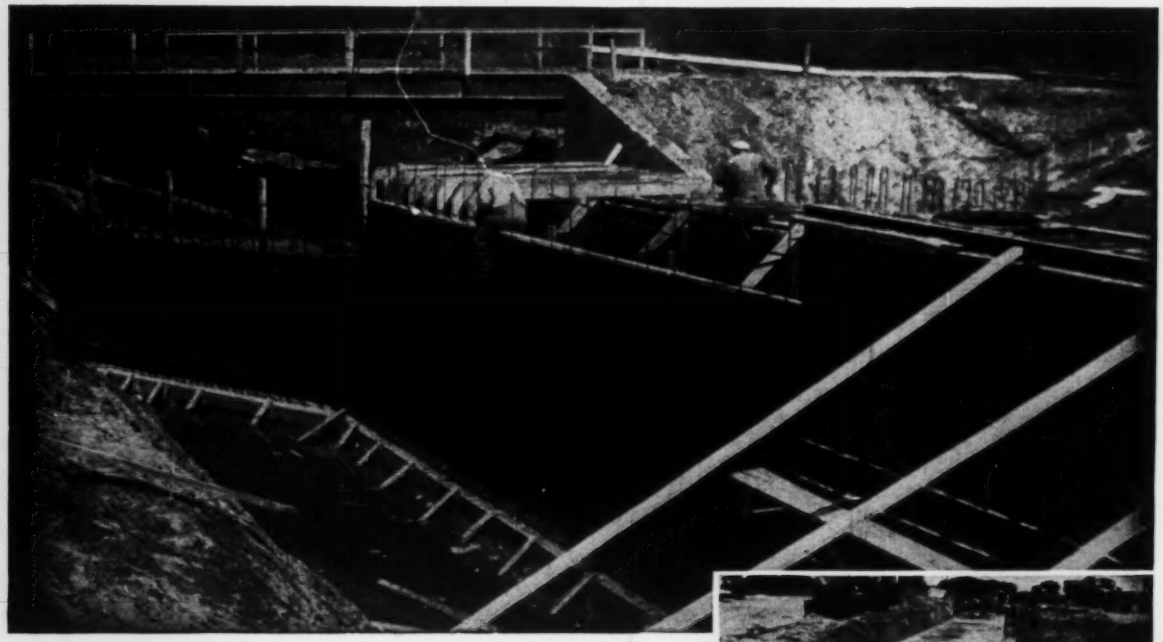

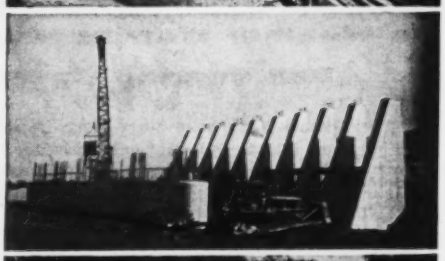

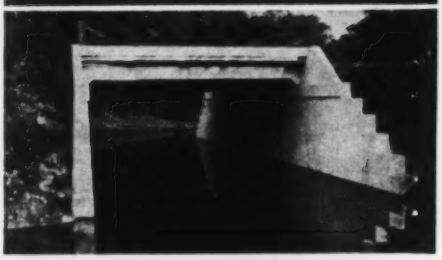

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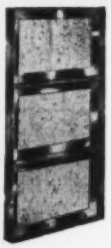

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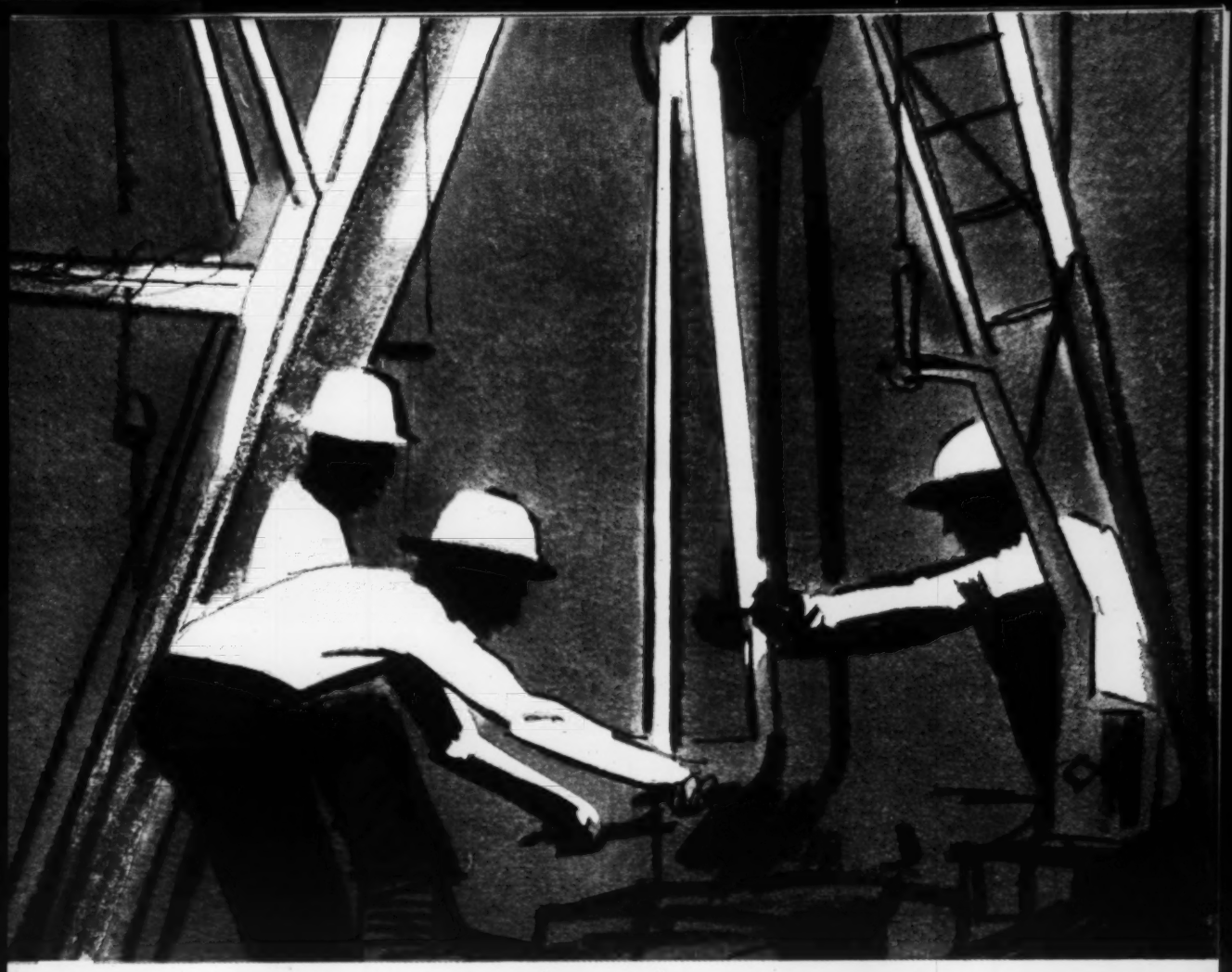

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Auditorium dome erected in 9 days by a 5-man crew

John J. Kane Hospital, Allegheny County, Pittsburgh, Pa. Auditorium is 109 feet in diameter, seats 682 people.

This auditorium dome for the John J. Kane Hospital went up in a hurry. Four workmen and one superintendent, using one crane with a 125-foot boom, erected the steel work in 9 days.

In preparation for the dome erection, a 20-inch pipe pole with a 48-inch diameter plate top was erected and plumbed. The spider or top section of the dome, which is about 11 feet in diameter, was then placed on top of the pole and bolted down.

The USS Structural Steel ribs were prefabricated on a 53'-7½" radius. They were made in two sections and were field-welded to form one rib almost 80 feet long, depending on the base elevation. The first rib was erected on the west side, followed by one on the east side. Erection then continued clockwise from both points.

The horizontal structural members were bolted in as erection progressed. Most of the bracing was omitted during erection and was filled in by the detail gang later on.

All sections were prefabricated in the plant of the Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

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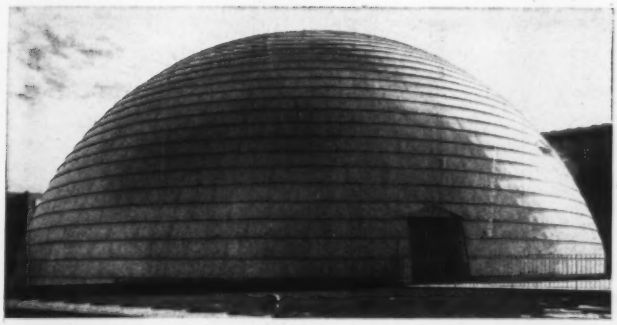

Auditorium dome fabricated from USS Structural Steel, erected by Adams Steel Erection, Kittanning, Pa. • Contractors: Sherry-Richards, Chicago, Ill. • Architects: Button and McLean—Mitchell and Ritchey, Pittsburgh, Pa. • Resident Engineer: Harry King, Allegheny County • Structural Engineers: L. W. Cook—R. A. Zern, Pittsburgh, Pa.

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Biographies of Civil Engineers Available

A new volume in the Dictionary of American Biography series, sponsored by the American Council of Learned Societies, includes a number of civil engineers. The new volume (Supplement II)—prepared under the editorship of Dr. Robert L. Schuyler, professor emeritus of history at Columbia University, and Dr. Edward T. James—includes 585 articles. It is confined to persons who died during the five-year period, 1936-1940. Announced for June publication, by Charles Scribner's Sons, Supplement II is available in a choice of bindings.

ASCE members in the new volume include Past-Presidents and Honorary Members Robert Ridgway and Lincoln Bush; Past Presidents Onward Bates, Harrison P. Eddy, and Louis C. Hill; and Honorary Members J. A. L. Waddell and Charles L. Strobel. Among the other notables—most of them members—are Hugh Lincoln Cooper, John Vipond Davies, Robert Fletcher, Elwood Mead, Ralph Modjeski, Daniel Edward Moran, and Joseph B. Strauss.

Russian Technical Literature Available

In view of the new interest in Russian scientific and technological achievements the Library of Congress reminds engineers that for the past several years it has been issuing monthly catalogues of Russian and East European literature accessions. *The Monthly List of Russian Accessions* sells for $12 a year, and the *East European Accessions List* for $10 a year. Both are available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C.

The title of each monograph and periodical is given in both the original language and English translation. Tables of contents of important periodicals are given in English translation. Each listing also includes a subject guide to the monographs and the periodical articles. Russian monographs are available from the Library of Congress and the cooperating libraries through interlibrary loan.

Vehicular Tunnel Links Key Japanese Islands

For the first time motor and pedestrian traffic between Japan's two main islands is possible, following completion early in March of a two-mile underwater tunnel connecting Honshu and Kyushu. The project, which has been under construction off and on for over twenty years, is expected to be tremendously important to the economic development of southern Japan.

Initial surveys for the tunnel were begun in 1935 after earlier plans for a suspension bridge over Kanmon Strait had been abandoned. Work on the project was first stopped for military considerations and then for the war. At all times it proceeded slowly because of geological and technical difficulties. Cave-ins and other disasters took 53 lives.

With a total length of 11,245 ft, the tube is second only to the 15,000-ft Mersey River Tunnel between Liverpool and Birkenhead. The underwater section is 2,575 ft long. The tube has two levels—an upper one for vehicles and a lower one for pedestrians. Its total cost was in the neighborhood of $27,778,000. With more than a million vehicles using the facility, it is expected that the cost will be repaid by tolls in about twenty-five years.

R. ROBINSON ROWE, M. ASCE

"I know why."

"Why what?"

"Why you called the animals feeding on one another xabs, yefs and zops," replied Joe Kerr. "It was so we could use x, y and z for the numbers of them."

"That's my boy," smiled the Professor. "Did you?"

"Sure. And I used time in centuries to eliminate fractions. So if the xabs have an 8 percent birthrate and are eaten by the yefs at the rate of .04 xab per yef per yr,

$$\dot{x} = 8x - 4y \qquad x_o = 936 \ldots\ldots (1)$$

and similarly for the others

$$\dot{y} = 7y - 5z \qquad y_o = 1{,}118 \ldots\ldots (2)$$
$$\dot{z} = 8z - 5x \qquad z_o = 962 \ldots\ldots (3)$$

Then, following your suggestion, I added these 3 equations to find

$$p = 3p \qquad p_o = 3{,}016 \ldots\ldots (4)$$

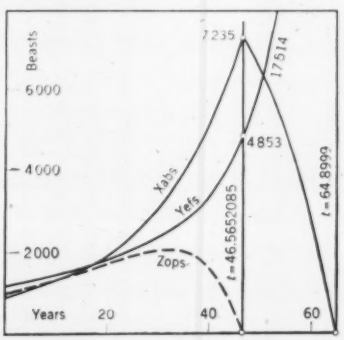

Fig. 1. Zops are eaten, xabs frozen, and yefs starved.

$$p = 3{,}016\, e^{3t} \ldots\ldots (5)$$

"After that I tried to extend your 2-variable method to 3 variables, but it wouldn't work, so I went back to my old CPA method and figured what happened year by year for 47 yr. Curiously each tribe gained 30.16 per yr at first, but the xabs caught up with the zops in 9 yr and with the yefs in 17 yr and ate up all the zops in 47 yr, so . . . ."

"Sixth-grade methods for 14th-grade problems again," sneered Cal Klater. "Joe's equations are easily solved to find

$$x = 4A + 4B + 38C \ldots\ldots (6)$$
$$y = 5A - 21B - 11C \ldots\ldots (7)$$
$$z = 4A + 17B - 27C \ldots\ldots (8)$$

where $A = 232\, e^{3t}$, $B = 2\, e^{10t} \cos 4t$, and $C = e^{10t} \sin 4t$. And when $z = 0$,

$$27 \sin 4t - 34 \cos 4t = 928\, e^{-7t} \ldots\ldots (8)$$

whence $t = 0.465652085$ centuries. From (6) and (7), there were then 7,235 xabs and 4,853 yefs. So the fates you asked for were: zops eaten, xabs starved to death, and the yefs doomed to necrophagous scavenging."

"I wish Cal had let me finish," complained Joe. "I figured the yefs would be smart enuf to preserve the xabs in their deep freeze so as to live in plenty another 18 yr. So I say the xabs were frozen and ultimately the yefs were the ones that starved."

"The lady or the tiger again! I like Cal's math and your imagination. Now I suppose you are expecting a sequel with four kinds of animals on a mixed diet, but this would ultimately lead us from ridiculous whimsy to sublime reality.

"Reality can be intriguing, tho. Last February at the meeting in Chicago, the current value of the Voluntary Fund was reported and someone suggested contriving a problem with that value, in cents, as the answer. Here it is:

$$\begin{array}{r} \text{CARESS} \\ \text{TT} \\ \hline \text{OTIOSE} \\ \text{OTIOSE} \\ \hline \text{ACODORE} \end{array}$$

"Match each letter with a digit and the multiplication will produce the Voluntary Fund to the penny."

[*Cal Klaters were: Richard Jenney, Ed C. Holt Jr., O. Mibac Hoertz (J. N. Christiansen), Rudolph W. Meyer, David V. Messman, and H. Francis Finch. Also acknowledged is Laurence V. Degnan's solution to the January problem.*]

There were no delays with REINFORCED CONCRETE

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Petaluma Creek Bridge, illustrated above, was designed by the Division of Highways, Sacramento, California.

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News of Engineers

(Continued from page 26)

Gordon K. Ray has been appointed manager of the Highways and Municipal Bureau of the Portland Cement Association, Chicago. He will succeed **Leo M. Arms** who will take the position of technical adviser to the Bureau. Mr. Ray has been with the firm since 1945, and Mr. Arms since 1952.

George H. Nelson will take on the responsibilities of the presidency of the newly-named Law Engineering Testing Company, Atlanta, Ga. The firm has been known as the Law-Barrow-Agee Laboratories, Inc. Mr. Nelson, who has been in Atlanta since 1946, has served in the independent laboratory field for 24 years.

Samuel A. Greeley, well-known Chicago consultant, has been honored by the Chicago chapter of the Illinois Society of Professional Engineers with a special citation. The citation especially mentioned Mr. Greeley's "untiring efforts on behalf of the engineering profession and unselfish service to this society and his fellow engineers." Presentation of the award took place during an Engineers' Week program. Mr. Greeley is an Honorary Member of ASCE.

Don M. Corbett (left), district engineer of the Surface Water Branch, U. S. Geological Survey in Indianapolis, was honored in a recent ceremony for his 33 years of continuous Federal service. Robert H. Lyddan, assistant director of the Survey, Washington, D. C., is shown making the presentation of the personal citation and the service emblem. Aside from his excellent record in the field of water legislation, Mr. Corbett is a former president of the Indiana Section and a recent ASCE Director for District 9.

DECEASED

Comfort A. Adams (M. '23) age 89, outstanding industrial consultant and engineering educator, died in Germantown, Pa., on February 21. Dr. Adams had a long career of noteworthy achievements. A former dean of the Harvard Engineering School, he began his teaching career there in 1891 as the holder of two professorships. After his retirement from teaching in 1936, he served as consultant to major industrial concerns throughout the world, including the Budd Company and General Electric. Dr. Adams invented the automatic spillway gate system, now used in many of the largest dams. He was one of the founders of both the American Standards Association and the American Welding Society.

Frederick M. Andrus (A.M. '47) age 45, structural engineer with the Los Angeles County Department of Buildings and Safety, died recently in Los Angeles. Mr. Andrus was graduated from the University of Southern California with a degree in civil engineering. He had been in the service of Los Angeles County since 1937, serving as building inspector from 1939 until his death.

Benjamin F. de Barros Barreto (A.M. '29) age 59, superintendent of the Concession Division of the Sao Paulo Light Company, died in Sao Paulo, Brazil, on January 9. Mr. de Barros Barreto had been engaged in hydroelectric power development in his native country of Brazil since 1922. From 1925 on he was prominent in the Sao Paulo area. He had written several papers dealing with electric energy and hydraulic resources. Mr. de Barros Barreto was a former president of the Brazil Section of the Society.

B. F. de Barros Barreto

Morris Brooks (M. '29) age 69, consulting engineer, died on January 31 in Philadelphia, Pa. Mr. Brooks was a registered professional engineer in Pennsylvania. In his early career, he had served as estimator and general superintendent for Harrison C. Rea Contractors and Builders in Philadelphia. For many years, Mr. Brooks worked with the Bureau of Building Inspection, first as a building inspector, then as deputy chief.

Arthur P. Clark (A.M. '10) age 79, long-time civil engineer for Bethlehem Steel Company, died in Washington, D. C., on February 14. Mr. Clark, a native of Michigan, graduated from the University of Michigan. Most of his life was spent in Bethlehem, Pa., with Bethlehem Steel Co. While in Washington, Mr. Clark conducted a research project at the Bureau of Standards for the American Iron and Steel Institute. Mr. Clark was an expert on reinforced concrete.

William D. Crawford, Jr. (A.M. '54) age 52, supervisor of structural design for the Duquesne Light Company, Pittsburgh, Pa., died recently in Ambridge, Pa. A native of Ambridge, Mr. Crawford was graduated from the Pennsylvania State University and had also studied at Carnegie Institute of Technology. He had been with Duquesne Light for 18 years.

Edward T. Davis (M. '36) age 60, partner in Chester Engineers, consulting sanitary engineers of Pittsburgh, Pa., died at Oakmont, Pa., on February 6. Mr. Davis was graduated from Carnegie Institute of Technology and had been with Chester Engineers since 1922. He served on a number of sewage projects for eastern cities and worked on the design of three synthetic rubber plants during World War II. He became a partner in Chester Engineers in 1946.

Edward H. Deets (M. '31) age 70, retired engineer for the Maryland State Roads Commission, Clarksburg, Md., died there on February 24. A Washington & Lee University graduate, Mr. Deets had served intermittently with the State Roads Commission for much of his professional life. As a member of the firm, Maddox & Deets, he was engaged in the compilation of the first property atlas for suburban Montgomery County. Mr. Deets retired as right-of-way examiner for the State Roads Commission in 1957.

Nelson A. Eckart (M. '11) age 79, consulting engineer, died recently in San Francisco, Calif. Mr. Eckart was graduated from the University of California. Soon after graduation, he became resident engineer for the Standard Electric Company. He later served as chief assistant city engineer of San Francisco until he was promoted to general manager and chief engineer for the San Francisco Water Department—a position he held for more than ten years.

Frank L. Flood (M. '35) age 60, partner in Metcalf and Eddy, Boston engineering firm, died on February 14 in Needham, Mass. Dr. Flood, a graduate of Northeastern University's School of Engineering, lectured on sanitary engineering at Northeastern for a year during his long career with Metcalf and

(Continued on page 114)

MODERN WATER STORAGE at Pueblo, Colorado

750,000 gallon tank on 120 ft tower.
Diameter 62 ft. Head range 35 ft.

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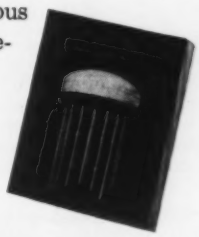

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(Continued from page 112)

Eddy. He joined the firm in 1925 and had been a partner since 1942. A sanitary engineering expert, he served as consultant on many sewage projects, including the Hyperion Sewage Treatment Plant in Los Angeles, Calif., and the Boston Metropolitan Sewage Disposal Works. Dr. Flood was a veteran of both World Wars.

Marcel Garsaud (M. '25) age 76, for the past nine years engineering consultant to the New Orleans Dock Board, died on February 11 in New Orleans, La. Mr. Garsaud, who was born in France, served on the Federal Power Commission by a 1930 appointment of President Herbert Hoover. Mr. Garsaud had also been with the Dock Board as an industrial relations director and as chairman of the engineering committee on the proposed Gulf of Mexico seaway. He served with the Corps of Engineers in both World Wars.

Fred J. Grumm (M. '36) age 73, chairman of the Sacramento Redevelopment Agency, died in Sacramento, Calif., on January 8. For many years, Mr. Grumm served with the California State Division of Highways where he played a major part in the development of the state's highway system. After his retirement from the Division, Mr. Grumm became connected with the Sacramento Redevelopment Agency.

Christopher F. Heiselman (A.M. '41) age 51, civil engineer for the New York City Board of Water Supply at Downsville, N. Y., died recently. He lived at Walton, N. Y. Mr. Heiselman, a specialist in soil mechanics, was investigating a proposed dam site on the Delaware River at the time of his death. He had been with the Board since 1938.

E. Clyde Hoge (M. '27) age 70, city manager for the City of Wyoming, Ohio, died there recently. Mr. Hoge was graduated from Washington & Lee University. He worked as construction engineer with H. H. Robertson Company in Pittsburgh; chief engineer for Keystone Fireproofing Company, in New York City; and general manager for the Lathrop-Hoge Gypsum Construction Company.

Robert Howes (M. '12) age 87, consulting engineer, died on January 31 in Seattle, Wash. Mr. Howes, a native of Dennis, Mass., was a civil engineering graduate of Brooklyn Polytechnic Institute and did post-graduate work at Cornell University. He had been a consulting engineer in Seattle for many years.

André L. Jorissen (M. '55) age 45, professor and head of the hydraulics and hydrology department at Cornell University, died in Ithaca, N. Y., on February 27. Professor Jorissen, a native Belgian, was graduated from the University of Liege, Belgium, and did post-graduate work at Massachusetts Institute of Technology. He had been engaged in engineering education ever since his graduation, serving as associate with the Belgian National Fund for Scientific Research; professor of civil engineering at Pennsylvania State College; and Hooker Fellow in hydraulics. He had published many articles in scientific publications.

J. Sterling Kinney (A.M. '42) age 48, head of the structural engineering department at Rensselaer Polytechnic Institute, died in Troy, N. Y., on January 29. Professor Kinney, a native of Millport, N. Y., had been with the Institute ever since he received his doctorate in civil engineering there in 1931. He had just published a book, *Indeterminate Structural Analysis*. Professor Kinney was a past-president of the Mohawk-Hudson Section.

Frederick L. Klein (M. '52) age 68, supervising bridge engineer with the Bureau of Public Roads, died in San Francisco, Calif., on February 16. Mr. Klein, who was a native of New Haven, Conn., was graduated from the Sheffield Scientific School of Yale University with a degree in civil engineering. He served as bridge designer with the Oregon State Highway Department before joining the Bureau of Public Roads. His work with the Bureau took him to Arizona as highway bridge engineer, then to San Francisco where he had been for over 25 years.

Frank B. Patterson (M. '56) age 50, programs control and planning coordinator with the Civil Aeronautics Administration, died in Oahu, Hawaii, on January 8. Mr. Patterson, a native of Sioux Falls, S. Dak., began his engineering career as junior resident engineer with the South Dakota State Highway Department. He had been with the Civil Aeronautics Administration since 1945, serving in a number of supervisory capacities.

Robert L. Stovall (J.M. '55) age 26, executive officer, U.S. Navy Civil Engineer Corps, died recently in Houston, Tex. Ensign Stovall, a recent graduate of Rice Institute, was honored as the outstanding member of his graduating class in the ASCE Student Chapter.

Walter H. Weiskopf (M. '37) age 59, partner in Weiskopf and Pickworth, New York consultants, died on January 26 in New York City. Mr. Weiskopf was graduated from Rensselaer Polytechnic Institute. He spent nine years in the design departments of the U.S. Steel Company and Carnegie Steel Company before joining the firm of Weiskopf and Pickworth, founded by his father. He participated in the design of a number of well-known buildings, including the new Union Carbide Building, the Hayden Planetarium, and Lever House, all in New York, and the new U.S. Senate Office Building in Washington, D. C. With his partner, John W. Pickworth, M.ASCE, Mr. Weiskopf invented a structural plate girder, known as a T-flange.

Gilbert C. Whitney (A.M. '14) age 74, retired chief signal engineer for the New York State Transit Commission, died on February 23 at his home in Dansville, N. Y. Before joining the Commission, Mr. Whitney worked with the old Brooklyn-Manhattan Transit Company and with the New York Central Railroad. As an expert for the Commission, he testified frequently at hearings on accidents and on proposed safety measures. Mr. Whitney retired in 1940.

Positions Announced

Alaska District, Corps of Engineers. Vacancies for all types of engineers in Alaska. Applicants must show graduation from recognized engineering school and be able to pass the Civil Service examination. For information write Personnel Bureau, U. S. Army Engineer District, Alaska, Corps of Engineers, P. O. Box 1288, Anchorage, Alaska.

Providence Redevelopment Agency. Planner IV opening is now available with the Providence Agency. Applicants must have redevelopment project planning experience, plus a degree in city planning, architecture, landscape architecture, civil engineering, economics or sociology. Experience in the federal urban renewal program is essential. Apply to James F. Reynolds, executive director, Providence Redevelopment Agency, City Hall, Providence 3, R. I.

Redstone Arsenal. Vacancies now exist for engineers GS-7, 9, 11-15. For application details, contact Executive Secretary, Board of U. S. Civil Service Examiners, Redstone Arsenal, Huntsville, Ala.

U. S. Air Force. Vacancies will be open for sanitary and industrial hygiene engineers with the Air Force starting in July 1958. Minimum requirements are a bachelor's degree in sanitary, civil, chemical or industrial engineering. Applicants must be less than age 34 at time of appointment. For details write Chief, Medical Liaison and Selection Division, Directorate of Staffing and Education, Office of the Surgeon General, USAF, Washington 25, D. C.

U. S. Navy. A vacancy exists for naval employment on Guam: GS-12, supervisor materials engineer. Applicants must show four-year engineering background plus 3½ years of materials engineering, soil mechanics, including foundation and earth work engineering and evaluation studies experience. Apply to Navy Overseas Employment Office (Pacific) Section B, 45 Hyde St., San Francisco 2, Calif.

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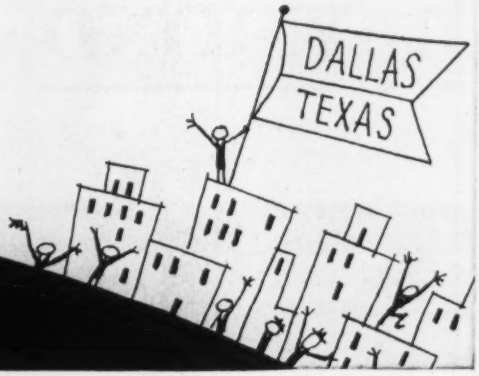

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RECENT BOOKS

(Added to the Engineering Societies Library)

Buildings For Industry

This selection of recent industrial building designs is accompanied by studies on the trends and factors prevalent in current practice. The philosophy and practical needs of the company are used to explain choice of site, plan, lighting, colors, location of loading docks, rail spurs, and employer facilities. Types of buildings studied include warehouses, light industry, consumer goods, manufacturing laboratories, utilities and service industries, and heavy industry. F. W. Dodge Corp., 119 West 40th Street, New York 18, N. Y., 1957. 309 pp., $9.75.

Highway Research Board Proceedings, 36th Annual Meeting

This collection of papers, presented at the 1957 meeting, covers virtually every phase of research activities in the field of highway administration and technology. The contents are grouped as follows: economics, finance and administration, including cost studies made in several geographic areas; design, with particular reference to airport pavement; materials and construction; maintenance; traffic and operations, including an extended study of the California Freeway capacity and soils. National Research Council, Washington 25, D. C., 1957. 834 pp. Price not given.

Indeterminate Structural Analysis

Following preliminary theoretical material, this book by the late J. Sterling Kinney explains the most frequently used methods of analysis. The general method of Maxwell with its modifications is presented as is the method of least work and an introduction to column analogy. Other aspects discussed are the slope deflection method, for prismatic and non-prismatic members, the method of moment distribution, influence lines, and the analysis of arches. A distinctive feature is the development of the principles involved in direct and indirect model analysis. An abridged edition for a one-semester course is available from the publisher for $7.50. Complete Edition. Addison-Wesley Publishing Co., Inc., Reading, Mass. 1957. 655 pp., $9.50.

Kempe's Engineer's Yearbook
Sixty-Third Edition

A new edition of a handbook covers virtually all fields of engineering. Although all sections have been rewritten to some extent, the following areas have been extensively revised: welding and cutting; water engineering; corrosion and protective coatings; blasting processes and new abrasive materials; aerodynamics and aircraft propulsion; electronic engineering; atomic power; heating, ventilating, and air conditioning. Morgan Brothers, Ltd., London, England, 1958. 2 vols., 82s.6d.

Living With The Sun, Vol. I

This first volume includes sixty plans selected from entries in the 1957 international architectural competition to design a solar-heated residence. Two principal solutions to the design of solar energy units are utilized. In the first the solar collectors are assumed to be an integral part of the house, while in the second the heat-collecting mechanism is kept as a separate entity. Design notes offer an explanation of the design and proposed method of operation, with an indication of the estimated heat loss and gain. Association for Applied Solar Energy, 2424 North Central Avenue, Phoenix, Ariz. 1958. XII pp., 60 plans, $6.00.

New in Education

Homework for the Teacher . . . The National Science Foundation is now accepting proposals from universities and colleges interested in sponsoring In-Service Institutes for Secondary School Teachers of Science and Mathematics, to be held during the academic year 1958-1959. A primary purpose of the program is to encourage teachers in outlying school districts to take advantage of scientific training facilities not otherwise readily accessible to them. Some 125 Institutes in colleges and universities have already been set up. Meetings will be held outside regularly scheduled school hours so that participants may attend while teaching full time at their schools.

Granted . . . Lewis L. Strauss, chairman of the Atomic Energy Commission, has just announced approval of grants totalling $3,499,638 to 55 American colleges and universities to be used to expand training facilities for increasing numbers of nuclear scientists and engineers. This brings to $6,764,388 the total amount for 91 training grants made by the Commission during the past 10 months, to 68 educational institutions.

Doctoral Program . . . The University of North Carolina has inaugurated a course of study in the department of sanitary engineering of the School of Public Health leading to the Doctor of Philosophy degree. Major fields of study include water supply and treatment, waste treatment and disposal, environmental sanitation, and atmospheric pollution control. Information from the Department of Sanitary Engineering, P.O. Box 899, Chapel Hill, N. C.

Academic Aid . . . Northwestern University's Transportation Center is offering several fellowships for graduate study in the transportation areas of civil engineering. The fellowships, which range from $1,800 to $3,000 a year, cover the academic year of 1958-1959. Recipients will be able to devote full time to their academic programs, as these fellowships carry no assigned duties. There are a number of fields in which the budding specialists may work: structural engineering, soil mechanics, sanitary engineering, fluid mechanics, and transportation. Applicants should contact Robert B. Banks, chairman of the Department of Civil Engineering, Technological Institute, Northwestern University, Evanston, Ill.

Quick Courses . . . The Department of Engineering at Pennsylvania State University is sponsoring two short courses in June and July. From June 29—July 3, a short course on "Materials Engineering Design for High Temperature" will be taught. This course will be closely allied with research and development of rockets and guided missiles. Other applications include gas and steam turbines, and equipment used in petroleum and chemical industries. The other course deals with "Mechanical Properties of Materials—Their Determination, Interpretation and Significance." For information write to Joseph Marin, Department of Engineering Mechanics, the Pennsylvania State University, University Park, Pa.

Atoms in Argonne . . . As a part of President Eisenhower's "Atoms for Peace" program, almost 70 scientists and engineers gathered recently for the sixth session of the International School of Nuclear Science and Engineering at the Argonne National Laboratory, Lemont, Ill. This program, conducted by the Atomic Energy Commission, included a tour of atomic energy installations throughout the United States, before beginning the two-part school session at Argonne. The first part consisted of six weeks of formal instruction, and was followed by the participants conducting individual research projects. The Argonaut, Argonne's low-power nuclear reactor, played a large part in the research which was concerned with the use of nuclear energy for peaceful purposes.

Newest Addition . . . This spring, the College of the City of New York will begin construction of an $8,000,000 center for its School of Technology. The center will enable the school to increase by 38 percent the number of engineers it will train in coming years. The six-story structure of reinforced concrete sheathed in marble and glass brick will resemble the college's new library. Both are designed by Lorimer & Rose, architects and engineers.

College Accelerates . . . Fenn College trustees have authorized acceleration of a $4 million construction program originally planned in two steps. In view of the nation's competitive need for more scientists and engineers, and the consequent need for expanded teaching facilities, the former Ohio Motors Building in Cleveland, Ohio, will be converted into engineering and science laboratories, a new library, and additional classrooms by fall of 1959.

Summer Study . . . Nine Institutes on Nuclear Energy for engineering educators will be held throughout the nation this summer under the sponsorship of the Atomic Energy Commission and the American Society for Engineering Education. The purpose of the Institutes is to provide special training in the fields of nuclear energy and the nature of nuclear reactor problems. The program offers four basic courses for those with no background in nuclear energy, four advanced-level courses, and one new basic course for teachers in technical institutes. For details contact W. Leighton Collins, Secretary, the American Society for Engineering Education, the University of Illinois, Urbana, Ill.

John Cameron Swayze, noted TV, radio news analyst, says: "I drove the new-type, *sound-conditioned* concrete—and couldn't believe my ears! It's bringing the riding comfort of 1975 *now.*"

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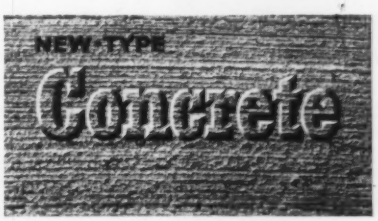

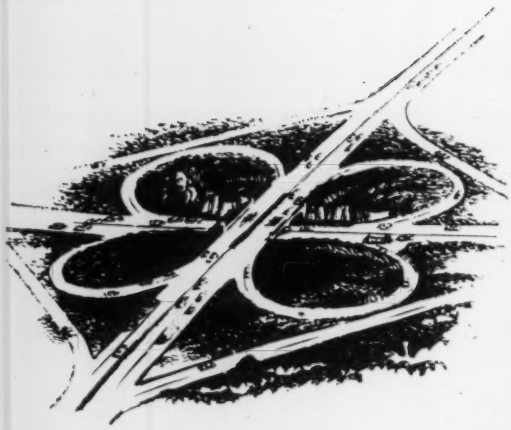

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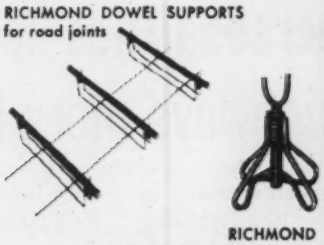

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RICHMOND
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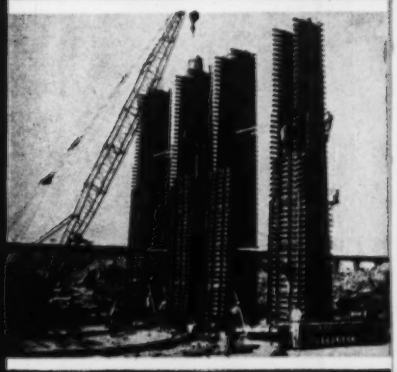

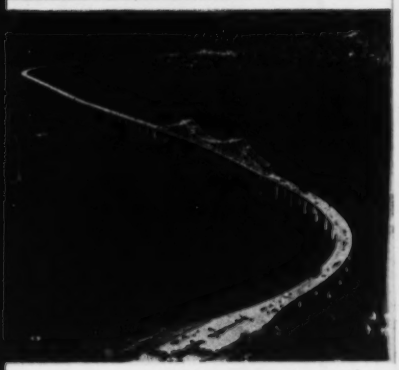

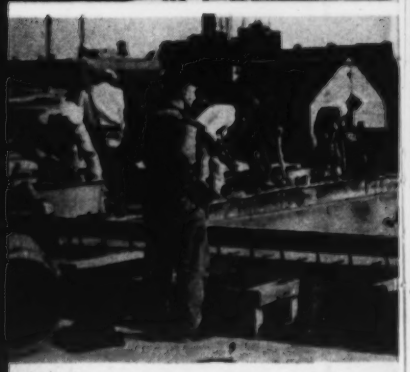

Shown here are a few of the items in the complete line of Richmond-engineered form-tying, anchorage and accessory devices for concrete construction. The Richmond Handbook describes all of them, gives wire and steel sizes used, safe loads and ultimate strength values. There is a Richmond product for every concreting need.

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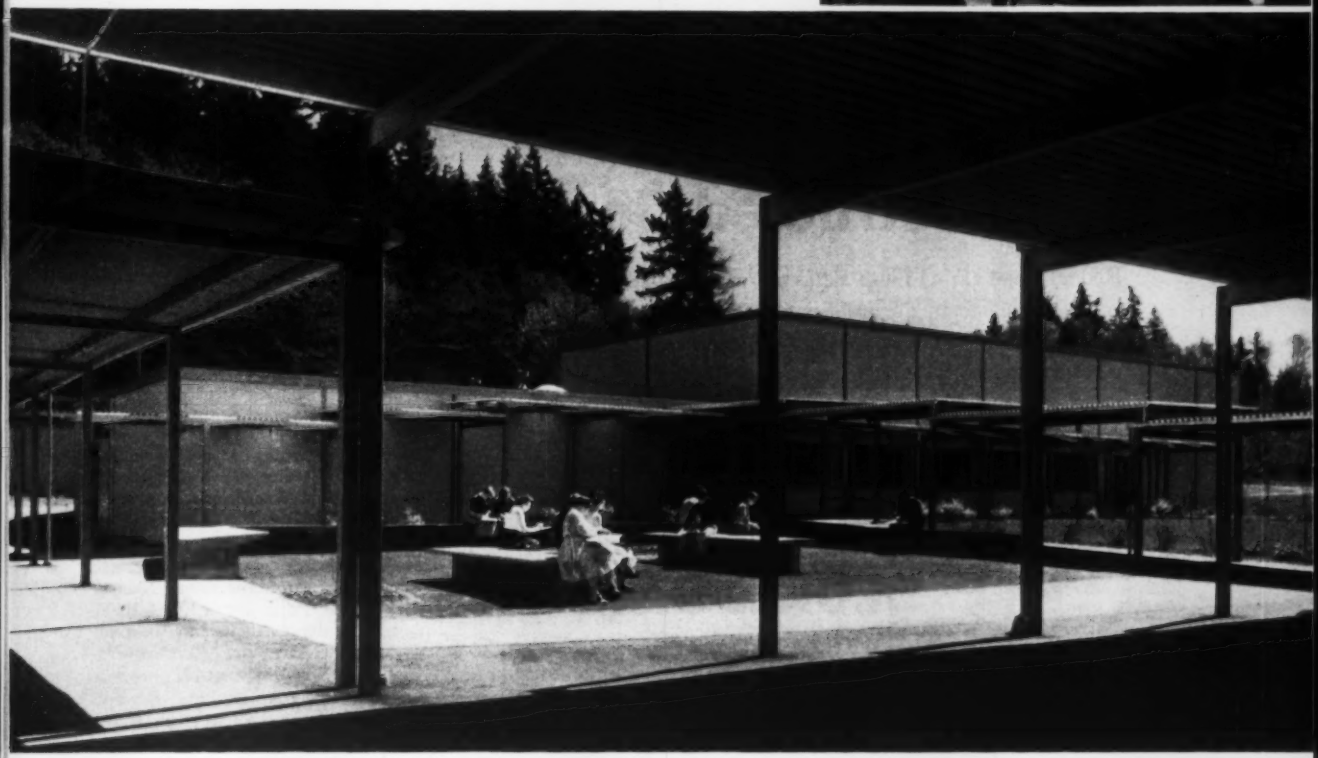

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The architect's objective was to provide a pleasant environment within an orderly structure. They felt it important also to provide inside and outside areas where students may congregate without congesting circulation space.

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Stock wide-flange sections form the window mullions, and longspan joists support the roofs. These open-web joists permit a uniform spread of natural and artificial light on the ceilings, so important in school buildings.

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Hedeen Construction Co.

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Stevenson & Rubens

Steel Fabricator and Erector:
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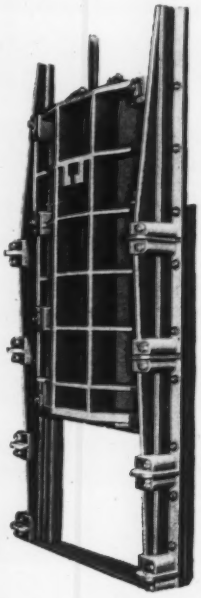

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Air Pollution Control Association, Annual meeting at the Sheraton Hotel, Philadelphia, Pa., May 25-29. For information write Milton Reizenstein, president of the Association, 4400 Fifth Ave., Pittsburgh 13, Pa.

American Institute of Chemical Engineers. Canada-United States Chemical Engineering Conference, at the Sheraton-Mt. Royal Hotel in Montreal. Jointly sponsored by AIChE and the Chemical Institute of Canada, April 20-23. For further information write Raymond C. Mayer & Associates, 36 W. 46th St., New York, N. Y.

American Institute of Steel Construction. Tenth National Engineering Conference at the Chase-Park Plaza Hotel, St. Louis, Mo., on April 17 and 18. For details write AISC, Park Ave., New York 17, N. Y.

American Society for Metals. First Southwestern Metal Exposition and Congress at the Statler-Hilton Hotel and Texas Hall of State, Dallas, Tex., May 12-16.

American Water Works Association. Annual conference, April 20-25, at the Adolphus, Baker, Dallas, Statler-Hilton, and White-Plaza Hotels in Dallas, Tex.

American Welding Society. Annual Meeting and Welding Show in St. Louis, Mo., April 14-18. For information write the Society, 33 West 39th St., New York 18, N. Y.

Atomic Energy Commission. Fifth International Electronic and Nuclear Energy Exposition in Rome, June 16-30. Details from John Vinciguerra, assistant manager, AEC Savannah River Operations Office, Aiken, S. C.

Building Research Institute. Seventh Annual meeting at the Shoreham Hotel, Washington, D. C., April 21-23. Information from the Institute, 2101 Constitution Ave., Washington, D. C.

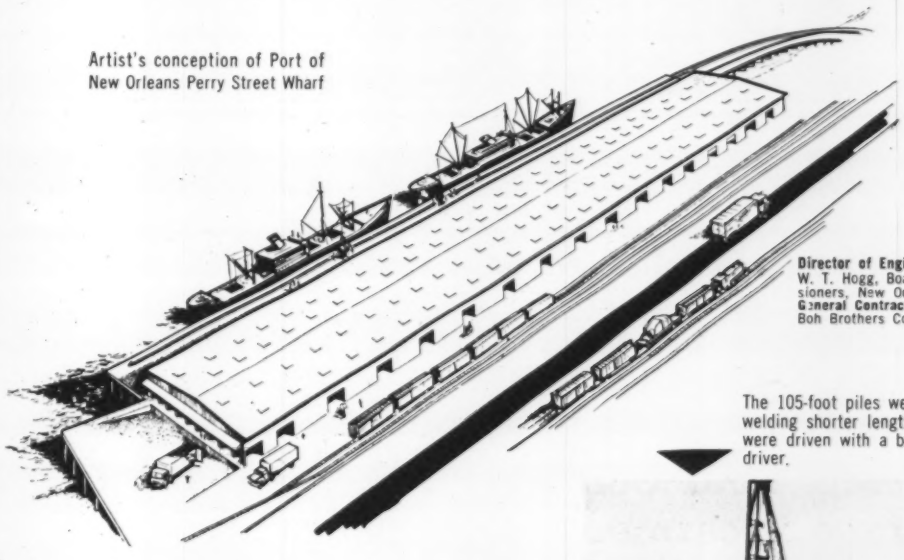
Fédération Internationale de la Précontrainte. Third International Prestressed Concrete Congress, May 10 at the Benjamin Franklin Congress Hall, Zeltenalee, Berlin-Tiergarten, Germany. Information from Congress Secretary Ing. P. Misch, Deutschen, Beton-Verein, 61 Bahnhofstrasse, Wiesbaden, P. O. Box 543, Germany.

Purdue Industrial Waste Conference. At Purdue Memorial Union Building, May 5-7. For details write the Purdue Union Club, Lafayette, Ind.

Seventh Southern Municipal and Industrial Waste Conference. Sponsored by the College of Engineering, Duke University, the University of North Carolina, and N. C. State College, on the Duke campus, Durham, N. C., on May 1 and 2.

Society for Experimental Stress Analysis. Spring meeting at the Hotel Manger, Cleveland, Ohio, May 14-16. For information, write to Dr. W. W. Murray, care of the Society, P. O. Box 168, Cambridge, 39, Mass.

More than 50 miles of Armco Piling provide solid foundation for New Orleans wharf



Artist's conception of Port of New Orleans Perry Street Wharf

Director of Engineering
W. T. Hogg, Board of Port Commissioners, New Orleans, Louisiana
General Contractor
Boh Brothers Construction Company

The 105-foot piles were made by field-welding shorter lengths together. Piles were driven with a barge-mounted pile driver.

The 1000- by 230-foot Perry Street Wharf is part of the Port of New Orleans' 72 million dollar dock improvement program. When completed, this wharf will include berths for loading and unloading two ships, dockside rail lines, truck docks, and a 160,000-square-foot warehouse.

Armco Pipe Piles were selected to provide a solid foundation for the wharf. A total of 2800 piles in 18-, 16-, 14-, and 12¾-inch diameters were driven and filled with concrete. The Armco Piles, field-welded in 105-foot lengths, were tied into the wharf deck with 1-inch reinforcing bars. Design load for each pile is 50 tons.

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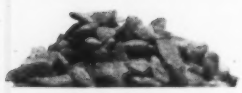

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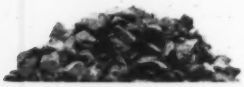

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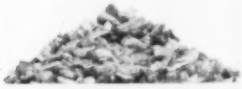

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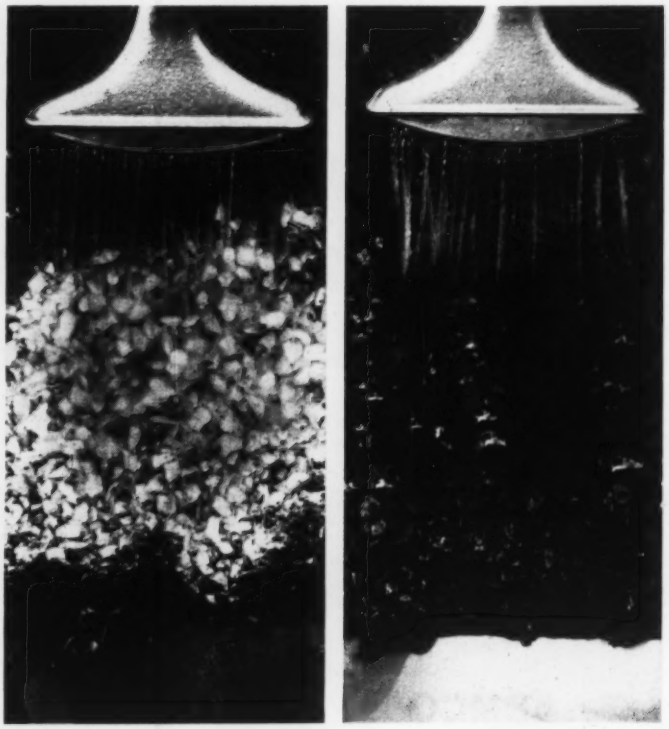

Proof... the superior coating and holding properties of new **CATIONIC** Bitumuls are clearly demonstrated in this test. Note the almost-complete wash-out of the conventional road binder (left); while **CATIONIC** Bitumuls (right) firmly holds the crystal-silica chips used for these test mix samples.

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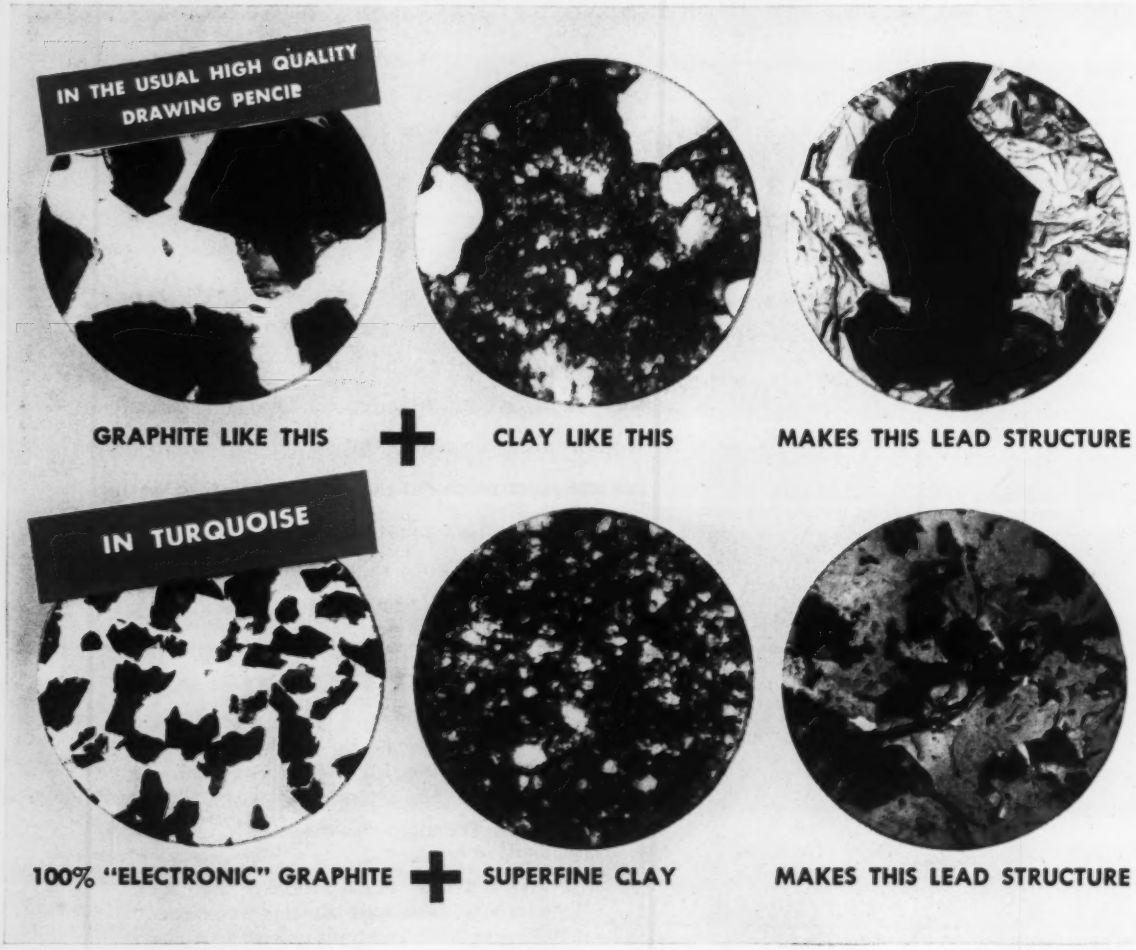

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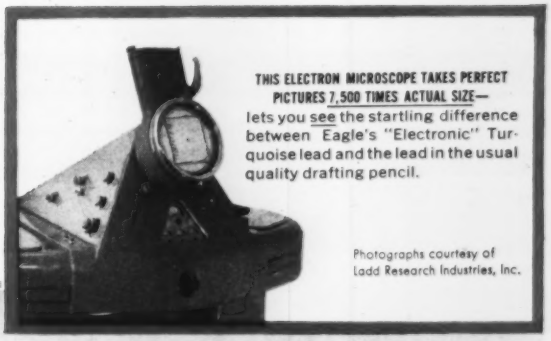
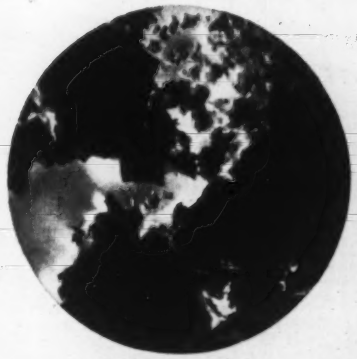


THIS ELECTRON MICROSCOPE TAKES PERFECT PICTURES 7,500 TIMES ACTUAL SIZE—lets you see the startling difference between Eagle's "Electronic" Turquoise lead and the lead in the usual quality drafting pencil.

Photographs courtesy of Ladd Research Industries, Inc.



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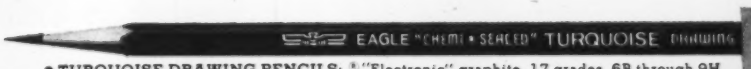

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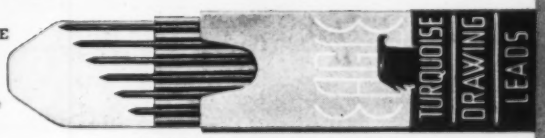

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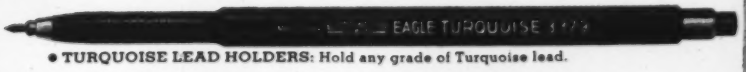

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New Publications

Technical progress review . . . The United States Atomic Energy Commission has announced publication of a new journal to be issued quarterly reporting on current results of both research and development, and on progress made, on specific reactor types. The first journal on "Power Reactor Technology" was prepared by W. H. Zinn of General Nuclear Engineering Corp. Available from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. at 55 cents per copy, or subscription can be obtained at $2.00 per year.

Composite beams . . . In "Composite Beams with Stud Shear Connectors," Bruno Thurlimann describes the use of composite beams as structural members and the value of stud shear connectors. The booklet, part I of a report of an engineering test conducted by the Fritz Engineering Laboratory of Lehigh University, is available from the sponsors, K S M Products, Inc., Merchantville 8, N. J.

Atomic energy . . . "Guide to Atomic Energy Literature for the Civilian Application Program" now in its first revision, is available from the Atomic Energy Commission. Issued as TID-4573, the bulletin gives current information on material available to program participants. Free copies may be obtained from the AEC, Technical Information Service Extension, P. O. Box 1001, Oak Ridge, Tenn.

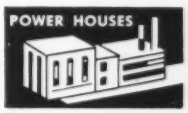
Highway improvement . . . The many-faceted implications of the new highway program were discussed at a recent conference on the "Economic Impact of Highway Improvement." Proceedings of the conference are available as Special Report 28 of the Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C. The price is $2.80 per copy.

County roads . . . A step-by-step plan for the management and improvement of county roads is outlined in a new bulletin published by the National Association of County Engineers. Address inquiries to the Association, 1721 DeSales Street, Washington 6, D. C.

Cylindrical Shell Study . . . A report treating the buckling and post-buckling behavior of a cylindrical shell subjected to uniform external pressure p on its largest lateral surface, and an axial compressive force F, has been issued as Bulletin No. 443 of the University of Illinois Engineering Experiment Station. Written by Henry L. Langhaar and Arthur P. Boresi, the pamphlet is available from the Station, University of Illinois, Urbana, Ill., for $1.00.

Concrete research . . . Three new bulletins have been made available by the Portland Cement Association: "Laboratory Investigations of Rigid Frame Failure;" "Lightweight Aggregates for Concrete Masonry Units;" and "Ultimate Strength of Reinforced Concrete in American Design Practice." Inquiries should be addressed to the Association, 33 West Grand Avenue, Chicago 10, Ill.

Welding . . . A comprehensive set of bibliographies of articles which have appeared in the *Welding Journal* during the past 20 years has been prepared by the American Welding Society. A set of 28 bibliographies, arranged according to topic, is available for $5.00; a single bibliography is 50 cents. The society also offers a bulletin on Filler Metal Comparison Charts, based on classifications made by the AWS and ASTM. The price is $2.00. Orders should be sent to the AWS, 33 West 39 Street, New York 18, N. Y.



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ENGINEER, graduate civil and structural, experienced. Will design complex steel structures, reinforced and prestressed concrete. Permanent. Company will pay moving expenses. Salary open. Location, Midwest. W5872.

CIVIL ENGINEER, young, with actual experience in highway engineering. Career connection with national organization having continued interest in highway engineering, research and construction. Give full details in first letter. Location, East. W5894.

ENGINEER-WRITER, graduate civil engineer, 35-45, with several years' work in design and construction in structural steel, either with a consulting engineering office or with a structural steel fabricator; some experience in writing technical reports and preparing text for advertising or promotional bulletins. Will handle correspondence, etc. from consulting engineers seeking technical information or assistance on special engineering problems; furnish technical advice and guidance on selecting and digesting articles; do creative writing for promotional booklets and technical data sheets, etc. Salary open; insurance and retirement plans available. Location, New York, N. Y. W5897.

TEACHING PERSONNEL for Department of Civil Engineering, (a) Instructors, to teach surveying, engineering mechanics, strength of materials and fluid mechanics. Master's degree preferred but not absolutely required. (b) Assistant or associate professor to teach soil mechanics, foundations and structures. Master's degree with special training or experience in soil mechanics required. Salaries: (a) $5,000; (b) $6,000-$7,000 for academic year. Available September, 1958. Location, upstate New York. W5898.

PROJECT DESIGN ENGINEER, graduate civil, with extensive experience in structural steel and reinforced concrete design for industrial building. Salary, $10,000-$12,000 a year. Location, New York, N. Y. W5911.

COMMONWEALTH OF AUSTRALIA

THE SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY

invites applications

FOR THE POSITION OF

CHIEF CIVIL ENGINEER

Salary £3,800 *(Australian)*

Applicants must possess recognized professional qualifications and have wide experience in the investigation, design, and construction of major civil engineering works.

The Chief Civil Engineer is directly responsible to the Authority for the management and conduct of the Authority's civil engineering activities, including the co-ordination and integration of the work of the Civil Design Division, the Major Contracts Division, and the Scientific Services Division.

Only those with successful experience in high executive positions and with proven engineering and administrative ability will be considered.

Information on superannuation, leave and other conditions of service is available on application to Liaison Officer, Snowy Mountains Hydro-Electric Authority, c/o U. S. Bureau of Reclamation, Federal Center, Bldg. 53, Denver 2, Colorado.

Headquarters of the Authority is at Cooma, New South Wales, where housing on a rental basis will be available for the successful applicant on taking up duty.

Applications, stating name, age, marital status, present position and salary, together with full and detailed particulars of past experience, should be addressed to the *Business Manager*, SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY, Post Office Box 332, Cooma North, N. S. W., Australia. *Applications should be forwarded immediately.*

Applications for Admission to ASCE, Feb. 2—Mar. 1

Applying For Member

ELMER LEE ANDERSON, Springfield, Mo.
FERDINAND WALDERMERE ARNOLD, Philadelphia, Pa.
ROBERT MYRON ARNOLD, Cuyahoga Falls, Ohio
GRANT L. ASHDOWN, Detroit, Mich.
HAIG AYANIAN, Millbrae, Calif.
SHEWELL REGINALD BANKS, Banbury, England
LEROY BARTLETT, JR., New York, N. Y.
JULIAN ESTEN BETTS, Washington, D. C.
EDWARD STICKNEY BROWN, JR., Hanover, N. H.
WILLIAM L. COTTLE, JR., Baltimore, Md.
JAN BRUNON CZAKI, Linden, N. J.
LESTER HENRY DAVIES, Allen Park, Mich.
GILBERT ALFRED DEAN, Kenya Colony, Africa
ALBERT MORRIS DILWORTH CASSEL, Syracuse, N. Y.
FREDERICK EMMET DINGMAN, Boston, Mass.
JACK EDWARD EISEMANN, Amarillo, Tex.
EDGAR ARNOLD ESAKOF, Johannesburg, South Africa
ANDRES FERNANDEZ-MADERA, Caracas, Venezuela
LOUIS WILLIAM FISCHEL, Salem, Va.
DAVID ROY FRANKFURTER, Seattle, Wash.
ROBERT CROWELL FURBER, Winthrop, Me.
CARL BRUNO GERBER, Arlington, Va.
LENARD ALOIS GRIGGS, Bardstown, Ky.
LAWRENCE GRIMES, Seattle, Wash.
DOSWELL GULLATT, San Antonio, Tex.
GWYNNE BYRNOS HILL, Oklahoma City, Okla.
ANDREW GUSTAF HULT, New York, N. Y.
JOHN WILLIAM HUSTON, Corpus Christi, Tex.
ROBERT DORRANCE INGALLS, Auburn, Ala.
SAUL MATRI JARCHO, New York, N. Y.
LEOPOLD HERBERT JUST, New York, N. Y.
ALFRED CHARLES KLAHRE, Honolulu, Hawaii
HENRY CARL LARSON, Jackson, Mich.
CHESTER LAVAUGHN LANDAKER, Honolulu, Hawaii
MERRITT CHARLES MCCLELLAN, Rolla, Mo.
DONALD NELSON MCCORD, Boston, Mass.
HARVEY LOCKWOOD MEYER, New York, N. Y.
FRANCISCO ZAMORA MILLAN, Mexico, D.F. Mexico
ELMER KENWARD NESBITT, Eltopia, Wash.
HENRY CHASE NEWELL, Concord, N. H.
JAMES JULIUS ODOM, Tuscaloosa, Ala.
MELVIN EDWARD OLSON, Whittier, Calif.
JOHN GRAY RANSOM, Rolla, Mo.
DARYL LEE ROBERTS, Juneau, Alaska
ROBERT LEON RUPLEY, Indianapolis, Ind.
ALEXANDER DAVID RUSSELL, Santa Cruz, Calif.
SABRI SAMI, Columbia, Mo.
JOHN MATHIAS SCHASER, Sacramento, Calif.
BERNARD SCHILLER, Castro Valley, Calif.
ALBERT THOMPSON SKINNER, Oak Ridge, Tenn.
ALBERT ROWLAND SOLISS, Anchorage, Alaska
FRANK ALEXANDER TEBO, Ambler, Pa.
WILLIAM HALL THOMAS, Boulder, Colo.
ROY FREDERICK THURSTON, Sacramento, Calif.
RICHARD JOHN VAN VEEN, Cincinnati, Ohio
HENDRIK VERMEREEN, East Orange, N. J.
WALTER KENNETH WAGNER, Albuquerque, N. M.
MALVIN HARRY WEEKS, Redding Ridge, Conn.
JOHN MATTHEW WILKERSON, JR., Atlanta, Ga.
FRANK EDWIN WISELY, St. Louis, Mo.
WILLIAM ADDISON WOOD, Oklahoma City, Okla.

Applying For Associate Member

RICHARD STERLING ADAMS, Anchorage, Alaska
RAYMOND ELSWORTH AMBLE, Minneapolis, Minn.
WILLIAM ARTHUR AYRES, Knoxville, Tenn.
RENE LOUIS JEAN BECCAT, Montreal, Que., Canada
JAMES MELVIN BRUNDAGE, Columbus, Ohio
FRANCIS PAUL BYSTROWSKI, West Hartford, Conn.
WILLIAM JAMES CAHALAN, Santa Fe, N. M.
DAVID FISHER CARPENTER, Boston, Mass.
JOSE MARIA CARRILLO, Caracas, Venezuela
EFREN AVILES CASTILLO, Guayquil, Ecuador
JAMES CECIL CROUCH, Topeka, Kans.
SYDNEY LOMAX CROOK, Boston, Mass.
JAYDEV M. DAVE, Minneapolis, Minn.
WILLIAM KRAFT DEIN, Ellenville, N. Y.
ROBERT EDWIN DICKEY, Milwaukee, Wisc.
ROBERT STANLEY DONALDSON, Waupaca, Wis.
ASBJORN RAGNAR ENGEBRETSEN, Evanston, Ill.
WALTON FARR, Dayton, Ohio
EUGENE LOUIS FIELDHAMMER, Wallingford, Conn.
LESTER RAYMOND FOX, Ephrata, Wash.
JOSEPH HARRISON GADDY, Rolla, Mo.
MAX ALTON GARDNER, Mt. Jewett, Pa.
JOSEPH D. GEORGIS, Karradah, Baghdad, Iraq
IRVING EDWARD GERMAIN, Stamford, Conn.
CHRISTOPHER DEMETREOS GIANAKIS, New York, N. Y.
RICHARD LUTHER GWINN, Lavaca, Tex.
GEERHARD HAAIJER, Pittsburgh, Pa.
FRANCIS CECIL GORE HANCOCK, San Francisco, Calif.
DON AKIBA HALPERIN, Gainesville, Fla.
DANIEL HOWARD HUSHION, Calgary, Alta., Canada
SYED RAFAT HUSSAIN, London, England
CONSTANTINE MILTIADIS IOKIMIDIS, Chicago, Ill.

STRUCTURAL

ENGINEERS
DESIGNERS
DRAFTSMEN

Prefer several years' experience in any of these fields:

BRIDGES

BUILDINGS
EXPRESSWAYS
HYDRO PROJECTS
TEST FACILITIES*

Will consider lesser experience with good educational background. Several recent graduates will be added to our structural staffs to round out this planned expansion program. Occasional openings for combination men in construction supervision and inspection; must be free to move and to assume office duties between assignments.

Sverdrup & Parcel, Inc., are professional engineers engaged primarily in design work covering a wide scope of practice. The variety and unusual character of our work, including as an example the proposed world's largest bridge project, offer excellent opportunities for individual and professional development and advancement.

We need a large number of men for our general offices in St. Louis and several for our branch office in San Francisco. These are permanent additions to our regular staffs. Confidential interview can also be obtained at Washington, D. C., and Portland, Oregon.

Paid vacation, sick leave, holidays, overtime. Employee Benefits Plan furnishes retirement income plus life and disability insurance. Blue Cross. Moving allowance.

Please write fully, including salary data, to

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915 Olive St. Louis 1, Mo.

* We are designers of the technical facilities for the Arnold Engineering Development Center, operated by our subsidiary, ARO, Inc.

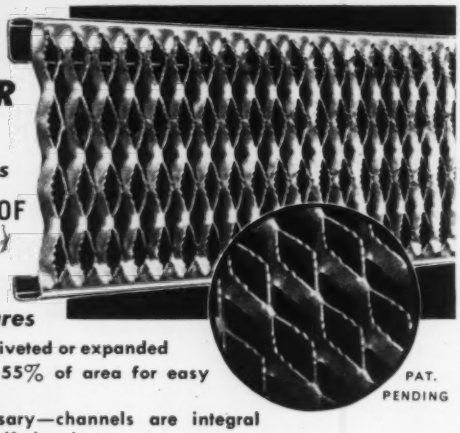
two superior open steel FLOOR GRATINGS

BY GLOBE

1 Safety GRIP-STRUT®

GRIP-STRUT Pat. Pend.

FOR MAXIMUM SAFETY ALL OVER YOUR PLANT



Important Safety Features

★ FIRE PROOF ★ SLIP PROOF
★ MAXIMUM STRENGTH
★ MINIMUM WEIGHT

Important Economy Features

★ All one piece, not welded, riveted or expanded
★ Open space in excess of 55% of area for easy access of light and air
★ No extra supports necessary—channels are integral part of the material. ★ Self cleaning
★ Cut and installed like lumber by your own maintenance force. ★ Low in original cost. ★ For balconies, no secondary sprinkler heads needed

PAT. PENDING

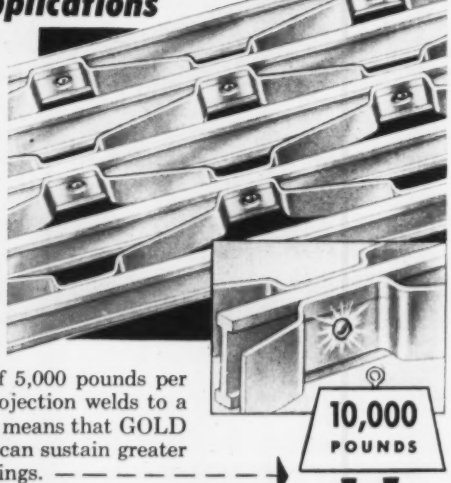
Ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

2 GOLD NUGGET® WELDED grating

PAT. PENDING

The QUALITY GRATING for Heavy Duty Applications

★ ⅜" projection weld nugget for greater rigidity and strength
★ Vertical alignment of the main load bar assured
★ All bars are load carrying bars including secondary bars
★ Anti-skid pattern



PROJECTION WELD

Each secondary load bar (A), as projected welded to the primary load bar (B) has a shear strength of 5,000 pounds per weld. There are 28 such projection welds to a square foot of grating. This means that GOLD NUGGET Welded Grating can sustain greater shock loads than other gratings.

For the complete details of these revolutionary new gratings, write for new catalogs today. Distributors in all principal cities. Consult the yellow pages in your phone book under "GRATING".

108

PRODUCTS DIVISION

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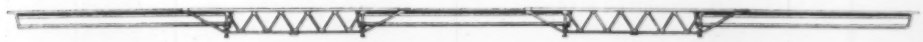
Fred W. Jones, New Castle, Del.
Jim D. Jones, Troy, Tenn.
Naji Abdul Kadir, Baghdad, Iraq
Lawrence Francis Keane, Jr., Willow Grove, Pa.
Julian Wylly Keck, Jr., Atlanta, Ga.
William Wilson Keeler, Clinton, Miss.
Guido Koeppel, Chicago, Ill.
Howard Bassett Leatham, Salt Lake City, Utah
Nilakantan Lekshmanan, Singapore, Malaya
Arvel Lonzo Lemmon, Prairie Village, Kans.
James Jackson Lewis, Versailles, Ky.
Frederick Arthur Limpert, Ephrata, Wash.
Nelson Anthony Luthy, Baltimore, Md.
Theodore Willingham Malphrus, Atlanta, Ga.
Lawrence Rumel Margetts, Sunnyvale, Calif.
Wilbur Dale Marshall, Norfolk, Va.
John Joseph McEvoy, Newark, Del.
Deam Clive McKee, Baton Rouge, La.
William Wesley Mendenhall, Jr., College, Alaska
Fred Atwood Merrithew, Lancaster, N. Y.
Carlton Kean Miller, Detroit, Mich.
Mohammed Shafi Minhas, Karachi, West Pakistan
Raymond Wilton Mitchell, Baltimore, Md.
William Henry Mitchell, Jr., Shreveport, La.
Aslam Murad, Denver, Colo.
Robert Lawson Myatt, Jr., Chamblee, Ga.
Marion Emanuel Nelson, Marysville, Calif.
Mutiullah Khan Niazi, Risalpur, West Pakistan
Gerald Stuart Odom, Birmingham, Ala.
Ude Stanley Tagbo Okoye, New York, N. Y.
John Edwin Olson, Sr., Elmhurst, Ill.
Malcolm Walker Paul, Princeton, N. J.
Dominic A. Perry, Meriden, Conn.
Dayton Stanley Pickett, Fort Belvoir, Va.
James Francis Pilley, Shawnee, Kans.
William Francis Pillsbury, Sacramento, Calif.
Francisco Salvador Planadeball, San Juan, Puerto Rico
Mark Moshe Porat, White Plains, N. Y.
Robert Powell, Madeira, Ohio
J. P. Rankin, Jr., Odessa, Tex.
Leonard Ugo Rastrelli, Wichita, Kans.
Rafael Viso Ride, Caracas, Venezuela
Norman Geoffrey Robson, Montreal, Canada
Rune Sigvard Sandberg, Brentwood, Mo.
Victor Murphy Sayers, Sacramento, Calif.
Richard Williams Saunders, Tehran, Iran
Lynn Andrew Seamans, Baytown, Tex.
Dev Raj Sikka, Morena, India
Jack Raymond Snead, Los Angeles, Calif.
Aris Constantine Stamatopoulos, Baghdad, Iraq
Miles Walter Stone, Pittsburgh, Pa.
Eugene Joseph Taggart, New York, N. Y.
Benson Alfred Tuchscher, Murray Hill, N. J.
Elton Gilbert Turnipseed, Jr., Jackson, Miss.
Carl Christian Ulstrup, Washington, D. C.
Bela Vadasz, San Francisco, Calif.
Heinz Wilhelm Vahlenkamp, Chicago, Ill.
Rama Shankar Varshney, Bahadrabad, India
Daniel Jimenez Velasquez, Wenonah, N. J.
James Ernest Warne, Jr., Phoenix, Ariz.
William Gladstone Westall, Park Forest, Ill.
Milton Jens Westin, Yakima, Wash.
John Edward Broezel Wilbur, San Diego, Calif.
Louis Bernard Wolfenson, Redlands, Calif.
William Robert Wray, Ft. Belvoir, Va.
Robert Zauner, Panama, R. P.
Edwin Ives Ziegler, New York, N. Y.

Applying For Junior Member

Stanley Martin Altman, Prairie Village, Kans.
Jose Maria Atucha, Caracas, Venezuela
Joseph Stanley Bereznicki, Alberta, Canada
Joseph Bernard Bohac, St. Louis, Mo.
Robert Lee Casten, St. Louis, Mo.
Shau-Yen Chang, Olympia, Wash.
James Norman Dornbush, Brookings, S. D.
Paul Joseph Eichhorn, Jr., San Anselmo, Calif.
Renato Moran Fernandez, Manila, Philippines
Robert William Fitzgerald, Worcester, Mass.
Santo Joseph Gozzo, Dorchester, Mass.
Arnold Joseph Hanson, New York, N. Y.
Robert John Hunt, N. Augusta, S. C.
John Karagozian, Jr., Gardena, Calif.
Gerald Ralph Massa, East Lansing, Mich.
Charles Richard Mertz, Philadelphia, Pa.
Edmond Trowbridge Miller, Atlanta, Ga.
Jacques Naar, Melrose, Mass.
Harold Otto Nuss, Peoria, Ill.
Homer Perry, Saluda, Va.
Nadigar Ramarao Nagaraja Rao, Bangalore, India
Abraham Ringel, Nashville, Tenn.
Alfred Edwin Robinson, Baltimore, Md.
Robert Edward Robinson, Wood-Ridge, N. J.
Cetin Seydemir, Cambridge, Mass.
Kanaiyalal Shroff, Cambridge, Mass.
Mete Avni Sozen, Urbana, Ill.
Werner Sebastian Storch, Portland, Ore.
Edmund Joseph Struzeski, Jr., Cincinnati, Ohio
Leon Richmond Taylor, Auburn, Me.
Sukru Muvaffak Uzumeri, Toronto, Ont., Canada
Dan Moody Wells, El Paso, Tex.

[Applications for Junior Membership from ASCE Student Chapters are not listed.]



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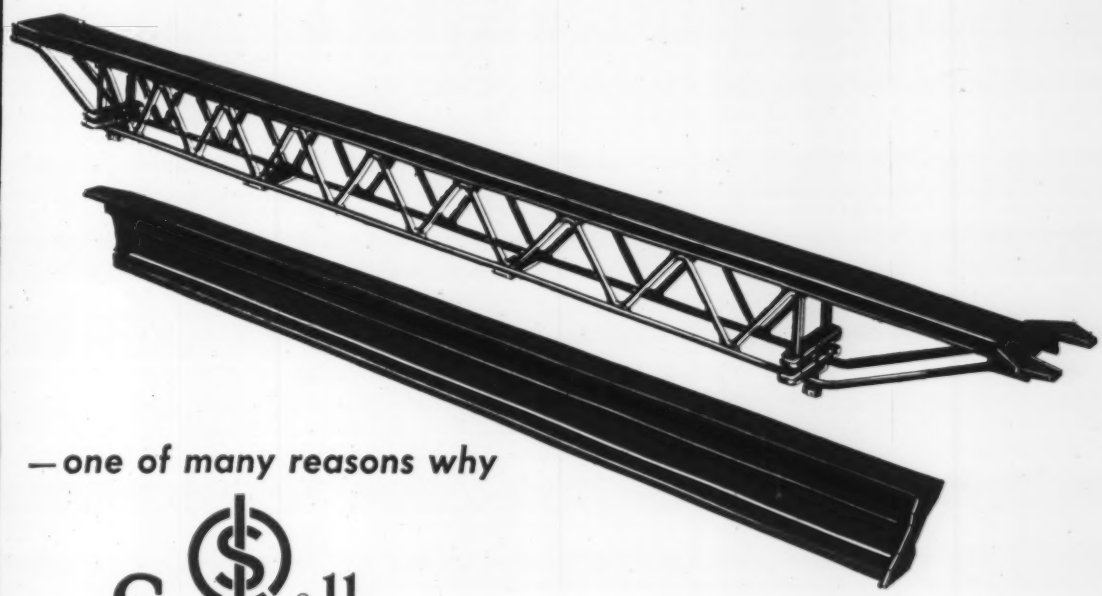

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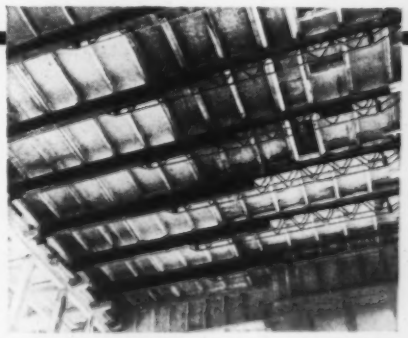
HORIZONTAL SHORING *is easiest! fastest! safest! cheapest!*

Practical advantages result from SPANALL, the universally used, all-steel Horizontal Shoring—and they all add up to new convenience, new speed of installation, and new savings in time and costs.

SPANALL HORIZONTAL SHORING applies to all types of construction, large as well as small...commercial and industrial buildings ...schools, hospitals and institutions...roadwork, culverts, bridges and piers...wherever concrete deck and floor forms must be constructed.

No matter where you use it, SPANALL either greatly reduces or entirely eliminates cumbersome vertical shoring—leaving the space below the forms free and clear for uninterrupted work progress, traffic or storage. Over-all savings average as high as 40%.



SPANALL HORIZONTAL SHORING with *built-in camber* is efficient time-saver on all floor and deck formwork: beam and slab...structural steel...metal pan...drop head...filler block.

Call your own Distributor, or write direct to Spanall, for Catalog detailing all practical, cost-saving advantages, including ample load bearing capacities and wide range of span lengths.

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CATALOG DIGESTS of ENGINEERING and INDUSTRIAL interest

1 ACKER HILLBILLY CORE DRILL

Acker Drill Co., Inc.—offers free of charge, Bulletin 29 which describes and illustrates a new lightweight diamond core drill. Two models are available. Hydraulic Feed Model weighs 1050-lb while the Mechanical Screw Feed Drill weighs only 872-lb. Both models have a built-in hoist and can be furnished when desired with a built-in water pump. Depth capacity is 500-ft.

2 ADJUSTABLE CURVE DRAFTING INSTRUMENT

Albert G. Daniels—A 4-page folder with photographs, specifications and prices illustrating the adjustable Curve Drafting Instrument is offered. These handmade instruments, placed on the market over ten years ago, continue to provide the draftsman with an easy, convenient way to obtain curves of long radius, and also irregular curves. Calibrated scale indicates actual radius of curvature or degree of curvature.

3 AERIAL MAPPING

Aero Service Corporation—Literature covering new and more economical applications of varied aerial mapping services is offered. These include aerial photography, topographic and planimetric maps from an aerial photographic base, precise aerial mosaics, and plastic relief maps. Services discussed are used in highway design, plant engineering, industrial development, city planning, and tax maps.

4 AERIAL SURVEY

Air Survey Corp.—Technical literature on photogrammetry is available, and also specific literature describing its application to highway engineering, city planning, volumetric computations of large piles, tax assessment, transmission line location, and other special applications.

PLEASE PRINT
NAME CLEARLY.

Mail This COUPON To-day

CIVIL ENGINEERING
33 West 39th St., New York 18, N. Y.

Date.....

Please have the literature indicated by the circled Catalog Digest numbers in the April 1958 issue sent to me without obligation.

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***There are charges for items Nos. 16, 46, 124, 227, 266, 272, and 288. See Notes below these items.**

To receive Literature—Firm Name and your Position must be given.

Name ..... ☐ Am. Soc. C.E. Member
(Please Print) ☐ Non-Member

Position .....

Firm Name .....

Firm Address—Street .....

City, Zone and State .....

NOT GOOD AFTER May 15, 1958, for readers in the U. S., but requests will be accepted to June 30, 1958, from readers outside of this country.

5 ALUMINUM-BASED ROOF COATING

Aluminum Company of America—Information is now available on new roofs in a can which are colorful, economical and easy to apply, and which have become the recommended cure for the housetop plagued with small leaks and old age. Now being marketed nationally, the new aluminum-based roof coating is available in eight eye-appealing colors, can be applied with a brush or spray, and keeps getting brighter with the passing years.

6 ALUMINUM BRIDGE RAILINGS

Reynolds Metals Company—This brochure is intended to supply architects and engineers with information on use of aluminum for bridge railings. A special section is included giving complete stress analysis data. Also shown are comparative data between aluminum and steel with information on how to design aluminum shapes having the same impact strength as steel. Design details, comparative cost data and suggestions for assembly and surface treatment are included in this 52-page booklet.

7 ALUMINUM GRATING

Borden Metal Products Co.—A new brochure by way of diagrams and photos illustrates the properties and uses of aluminum floor gratings. Also shown are tables of their specifications. A description of a new safety grating and new aluminum safety steps is featured.

8 ALUMINUM GRATING

Kerrigan Iron Works, Inc.—A 4-page brochure of engineering data and a safe load table on spark-proof Kerrigan Weldforged aluminum grating-open flooring, and stair treads is offered. Light weight, non-magnetic, noncorrosive, this grating has no maintenance cost and its high strength insures many years of service. It is now manufactured in types and sizes of grating for every need: steel, stainless, monel, aluminum, riveted, extra close spaced and serrated.

9 ALUMINUM GRATING

Klemp Metal Grating Corp.—An all new 4-page brochure describes Klemp's RR (rectangular riveted) Aluminum Grating. Photos of actual installations and applications, descriptions, diagrams, safe load tables and complete specifications are included.

10 ALUMINUM HIGHWAY RAILINGS

Aluminum Company of America—New highway railing designs, complete with technical information, are being offered the highway engineer. Compiled in a new booklet entitled "Alcoa Aluminum Highway Railings," the material encompasses all phases of the use of aluminum as railings on bridges and roadways. Over 30 models of parapet railing post designs are offered, including 18 available for the first time. With each of these new posts, complete photographic coverage of actual installations in every type of atmosphere across the nation is pictured.

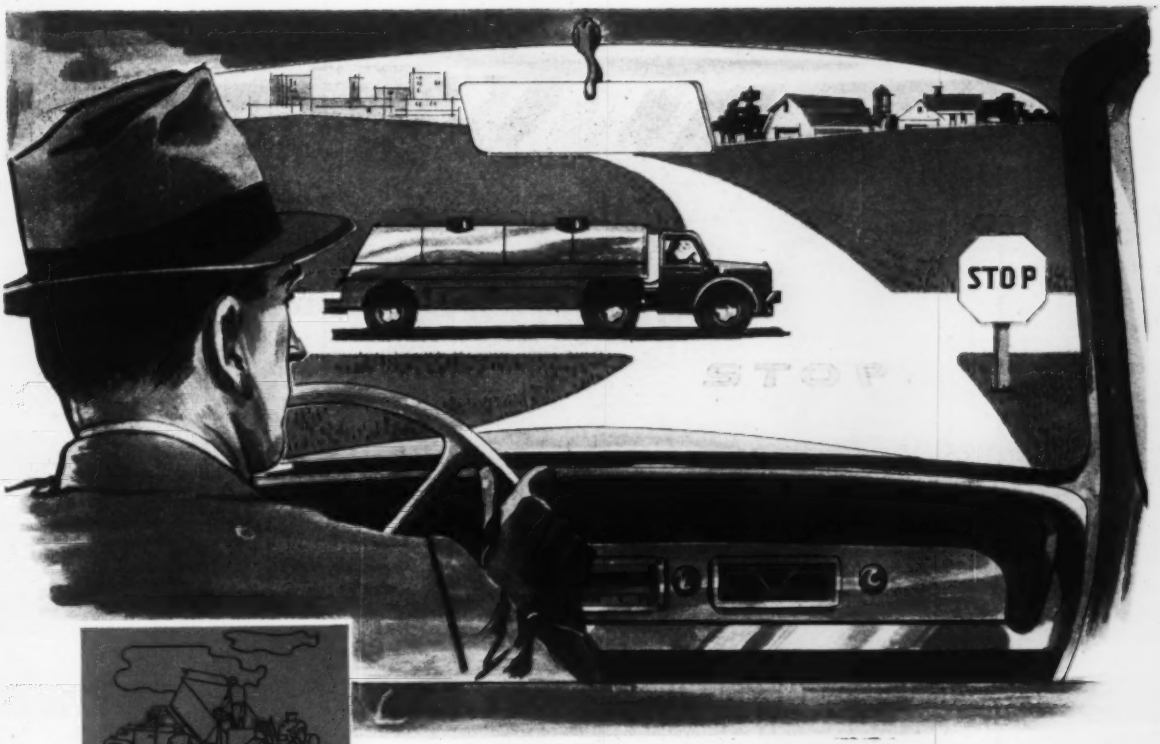
11 ALUMINUM HIGHWAY RAILINGS

Michael Flynn Mfg. Co.—This 38-page illustrated brochure contains construction and design specifications of aluminum highway railing. Some of the subjects discussed are panel type railings, standard cast posts, standard pipe, balusters, U-Bolt Anchors, and hand railings. A cross-section of each item is included.

12 ALUMINUM JOURNAL JACK

Duff-Norton Co.—This pamphlet discusses a 98-lb, easy-to-carry Aluminum Journal Jack with a 200,000-lb capacity. The compact unit is only 12-in. in closed height, has a base diameter of 8¾-in. and is less than half the weight of an hydraulic jack of the same capacity. Two bail-type handles make the jack easy to carry. It has a 4-in. raise and requires an effort of only 120-lb to lift 100 tons.

Use This Free Service—Mail The Coupon To-day



Give Safety a Rumble!

You've been driving hard. A long day. Sleepy. Suddenly, a loud rumble under your wheels brings you up sharp, alert. Good thing. There's a dangerous intersection right ahead. A truck whips by on the cross street.

That's when you'll appreciate the safety-thinking of the city, county or other highway-road authorities that specified blast furnace slag at dangerous intersections and highway turn-offs.

Versatile blast furnace slag has many uses. One of the newest is a surface course at such danger spots. It sets up a rumble under the tires of approaching cars that alerts the driver to "Danger Ahead."

Durable, long lasting blast furnace slag has a rough, vesicular surface that is highly skid and wear resistant. Slag is economical, assuring years of safe driving when other aggregates have become slick and dangerous.

For safety's sake . . . specify blast furnace slag, the safe, durable aggregate . . . your life insurance on the roads of today and tomorrow.

Blast furnace slag is a product of Birmingham Slag Division, Birmingham, Ala., and Lambert Division, Knoxville, Tennessee, of Vulcan Materials Company.

"ORGANIZED FOR SERVICE"

Vulcan Materials Company

P. O. Drawer 155 ☆ Birmingham 2, Ala.

THIS IS VULCAN MATERIALS COMPANY:

Birmingham Slag Division • Concrete Pipe Division • Consumers Company Division • Lambert Division • Vulcan Detinning Division
Asphalt Paving Materials Co. • Brooks Sand & Gravel Company • Chattanooga Rock Products Company • Frontier Chemical Company
Montgomery-Roquemore Gravel Co. • Rockwood Slag Products, Inc. • Stockbridge Stone Co. • Teckote Corp. • Wesco Materials, Inc.

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SPADONE-ALFA CORPORATION

SOUTH NORWALK, CONNECTICUT

CATALOG DIGESTS

13 ALUMINUM STREET LIGHT STANDARDS

Kerrigan Iron Works, Inc.—A new 16-page, loose leaf catalog containing illustrations and full engineering data on aluminum continuous tapered, octagon shaped poles for streets, highways, bridges, shopping centers, etc. Mast arms and brackets for short and long spans. Floodlighting and traffic signal standards, strain poles, accessories, modifications and bases.

14 ANNIVERSARY BROCHURE

Bristol Steel & Iron Works, Inc.—This 26-page illustrated booklet is a brief biography of the Bristol Steel Co.—of the man who founded it, of his sons and grandson who operate it and of the more than 400 men and women who work in it. This brochure prepared on the business' 50th Anniversary contains sections on jobs in progress and in the plants.

15 ARCHITECTURE, ENGINEERING & CONSTRUCTION CATALOG

F. W. Dodge Corp.—A new catalog containing descriptions and prices of books on architecture, engineering and construction is now available. Some of the titles discussed are: "Record Housing of 1956," "Japanese Temples & Tea-Houses," "Industrial Buildings," and "Design for Modern Merchandising."

16 ASPHALT CURBS & GUTTERS

The Asphalt Institute—"Specifications & Construction Methods for Asphalt Curbs & Gutters" combines the features of a popular brochure with the detailed engineering data of a manual. First issued as a popular booklet, the new and revised edition includes The Asphalt Institute specification with important Notes to the Engineer. An appendix includes the standard FHA specification for this type of construction. The price is $.20.

N. B. There is a charge for this book. Make checks payable to The Asphalt Institute.

17 ASPHALT LINER MANUAL

W. R. Meadows, Inc.—announces the availability of a "Hydromat" Asphalt Liner Manual. The "Hydromat" Manual fully describes applications and contains installation information, necessary technical engineering data and specification information. This is not a sales catalog, but strictly a Technical Data Manual.

18 ASPHALT PLANT

Madsen Works, Division of Baldwin-Lima-Hamilton Corp.—Catalog No. 800-A shows complete descriptions and illustrations of the Model 481 Asphalt Plant. This plant is available in capacities of 4000-lbs., 5000-lbs., 6000-lbs. and 8000-lbs. Plant features exclusive bin design, improved drive arrangement, and air operation of bin gates, asphalt pressure injection and mixer gate.

19 ASPHALT PLANT

Madsen Works, Division of Baldwin-Lima-Hamilton Corp.—Bulletin No. 391 illustrates and describes the new Model 391 Hot Rod Asphalt Plant. This plant is available in 3000-lb, 4000-lb, and 5000-lb capacities. This outstanding portable batch type asphalt plant features simple, streamlined design, fully enclosed gear box reduction unit, automatic operation (available as optional equipment), Twin-Shaft Pug Mill Mixer and many other engineered advancements.

20 ASPHALT PLANT

Madsen Works, Division of Baldwin-Lima-Hamilton Corp.—Catalog No. 20-S illustrates and describes the 2000-lb. SPECIAL Asphalt Plant. The plant is rated at 60 tons per hour, yet consistently produces in excess of 80 tons per hour. It is a portable plant, ideal for the not-too-large contractor, the municipality, and the large asphalt producer who has in mind a small permanent operation for producing about 480 tons per day.

21 ASPHALT PRODUCTS

Lewis Asphalt Engineering Corp.—Discussed in this 12-page booklet are such asphalt products as Karnak Asphalt Primer, Asphalt Emulsion, Brush Plastic and Karnak Floor Primer. Each product is accompanied by a list of typical uses, methods of application, specifications and where the product is used.

Here are some of the fine MARS drafting products, imported from West Germany, made to meet the highest professional standards. ● Bright-hued LUMOCHROM pencils come in 24 colors for color-coded drafting and perfect reproduction. ● LUMOGRAPH graphite drawing pencils come in 19 degrees. Some degrees available with erasers, some with special chisel points. ● TECHNICO lead holders for color and black graphite drawing have new sure-hold finger grips, with degree markings for quick identification. Also available with clips for pocket use. ● NON-PRINT pencil and leads let you make notes and sketches that will not reproduce. ● Pencil sharpeners come in STANDARD and "DRAFTSMAN" models; latter with adjustable point length feature.

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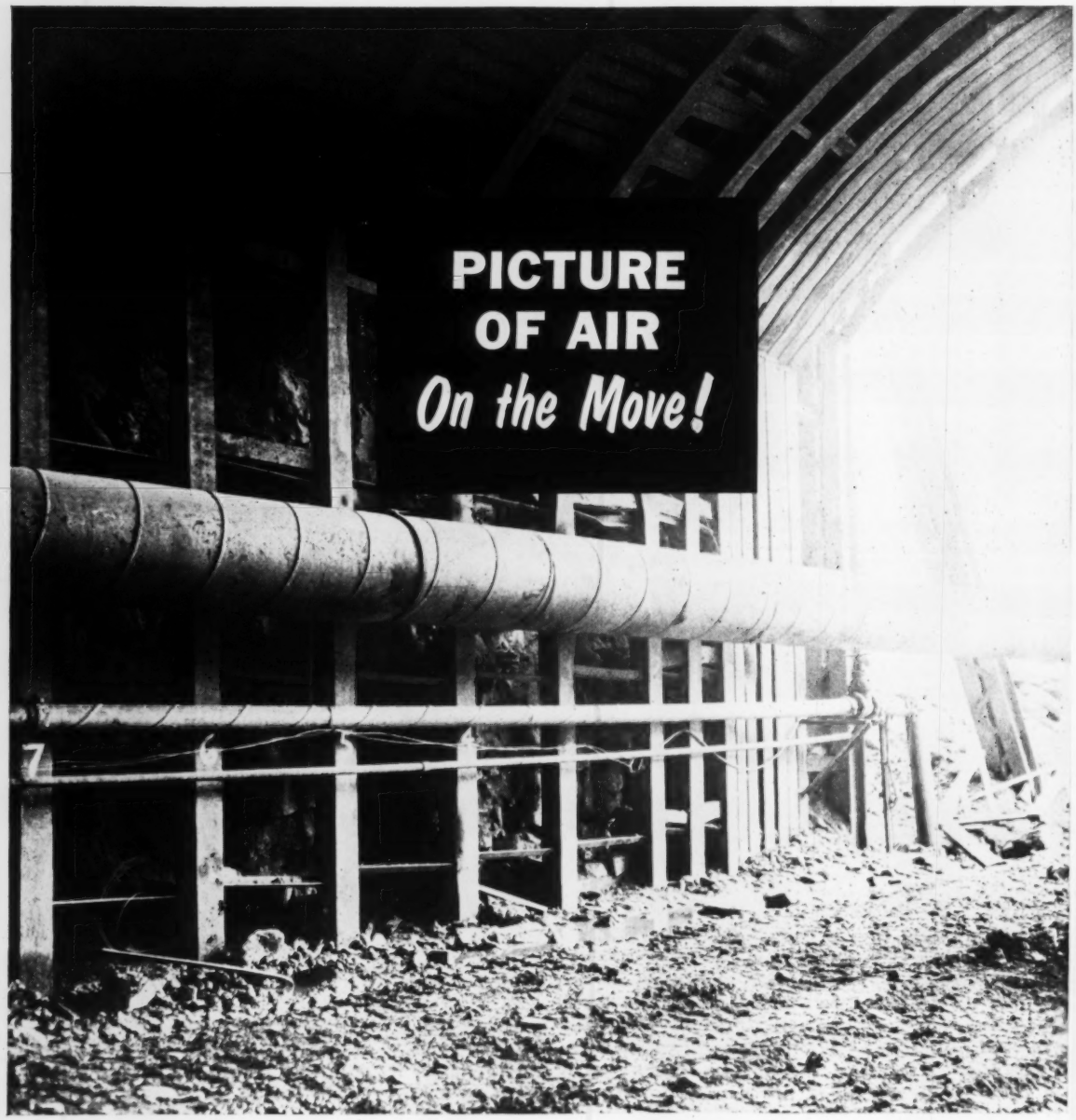

Lines of NAYLOR Spiralweld pipe provide a dependable way to move air. Getting rid of smokes, fumes and dusts; supplying fresh air for underground construction; or bringing in compressed air for operating tools, you can rely on this distinctive pipe to do the job.

NAYLOR pipe is light in weight, easier and more economical to handle and install—particularly with the one-piece NAYLOR Wedgelock coupling to speed connections. The spiral-lock-seam structure assures greater collapse strength and safety, making possible the use of lighter gauge material for economy in push-pull ventilating service.

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CATALOG DIGESTS

22 AUGER DRILLS—VERTICAL & HORIZONTAL

The Salem Tool Company—Earth and rock boring auger drills are described in Bulletin M-105. Features of horizontal blast hole drills are explained, as are the following features of truck-mounted and self-propelled drills: power unit, transmission, main drive case, carriage, main frame, hydraulic unit and elevating jacks.

23 AUTOMATIC COUPLERS

Mayo Tunnel & Mine Equipment—A simple and economical automatic coupler for small mine cars is described in a recent brochure. In addition, side-dump cars, rocker-dump cars, car passers, pneumatic grouters, and muck bins are explained and illustrated.

24 AUTOMATIC GATES

Thompson Pipe & Steel Co.—This catalog illustrates and explains 3 devices which control upstream and downstream water levels and flow without usual floats and supervision. On-the-job photos and diagrams show the many irrigation and water-works applications. These gates are made on the widely-adapted Neyrpic principle.

25 BATCHING PLANTS

L. O. Gregory Engineering—A new 12-page catalog which contains specifications for each of Gregory's Standard Cement and Aggregate Batching Plants, has been published. The back cover displays actual typical installations of batching plants as used by road builders, ready-mix plants, block plants, and pipe plants.

Please give your complete address.

26 BATCHING PLANTS

Noble Co—Two illustrated booklets concerning batching plants have been published. Some of the features discussed in the first pamphlet are: more overhead storage of each size aggregate; elevator head drive minimizes chain and sprocket wear; and rapid, accurate cement metering. In the second brochure, the Noble-Mobile is shown schematically and discussed. Some of its special points are: piggy-back extension which increases silo capacity to 2,500-cu ft; and aggregate bin charging conveyor.

27 BATCH TYPE ASPHALT PLANTS

Hetherington & Berner, Inc.—A few of the features enumerated in this brochure on Type "T" Batch Type Asphalt Plants are: all-welded plate construction, automatic cycle control, large feeder bins, and low pressure oil burners.

28 BITUMINOUS DISTRIBUTOR

Municipal Supply Co.—The new model Thriftline bituminous distributor recently introduced to the industry is fully described with two-color illustrations in Catalog T-100. Figures showing performance of the budget-priced model are given. A large, 2-page cutaway illustration of the Thriftline highlights sixteen desirable features. Six drawings are used to show how the simplified distributing system works. A complete list of dimensions, weights, standard and extra equipment is included.

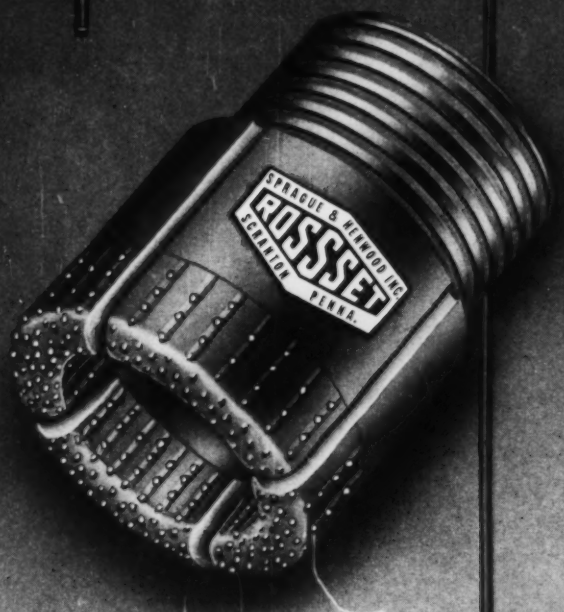
29 BLUE-PRINT-SAMPLER

Venus Pen & Pencil Corp.—offers free a new Blue-Print-Sampler with two popular Venus B/P Blueprint pencils and one Venus Drawing pencil. The B/P pencils with specially formulated lead are guaranteed to give the precise, consistent performance required for markings on white or blueprints and on coarse papers. Available in an assortment of 8 electronically controlled accurate colors which allow high contrast markings that resist oil, dirt and grime.

30 BOILER AND STOKERS

The James Leffel & Company—Complete descriptive and specification information on rugged Scotch boilers for gas, oil and coal firing and automatic underfeed stokers for Scotch type boilers is given in a 28-page bulletin 236. This richly illustrated brochure includes test results, performance data, and complete details of design and construction.

THERE IS THE RIGHT BIT FOR YOU... OUT OF A POSSIBLE COMBINATION OF THOUSANDS OF SIZES AND TYPES



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31 BORALLOY

Caterpillar Tractor Co.—A first in the heavy machinery industry and a Caterpillar exclusive are the new Boralloy sprockets for Cat D8 and D9 tractors. Illustrated throughout with photographs, drawings and cutaways, this 8-page booklet describes the manufacture of these sprockets with emphasis on the role the element Boron plays in creating depth of hardness.

32 BORINGS

Raymond Concrete Pile Co.—A booklet "Subsoil Investigations for Foundations" Catalog B-7 explains the reason for subsoil investigations, what Gow borings are and how they are made, and the results obtained. Illustrated are methods for making borings and taking samples, and various types of rigs in operation.

33 BRIDGE FLOORING

American Bridge Division—This 32-page booklet contains complete engineering drawings and design data for all available I-Beam-Lok sizes, plus detailed coverage of Specifications, including the type of steel, erection, fabrication, painting, field assembly and welding. A brief discussion of composite T-beam action between I-Beam-Lok flooring and steel stringers is also included.

34 BUILDING SAVERS

L. Sonneborn Sons, Inc.—An eight-page brochure of building construction and maintenance data covering the company's waterproofings, floor treatments, admixtures and protective coatings. The product descriptions include definitions, directions, advantages, coverage and specifications. Known as Building Savers, these quality products are the tested solutions to your building construction and maintenance problems.

35 CABLE SUPPORT

Globe Co.—Two systems of support for all types of cable, wiring and tubing are described in an 8-page illustrated catalog. These systems have been engineered to be used interchangeably with each other depending on the weight of the load to be supported at any given location. Globe-Tray, the ladder type tray and Cable-Strut, the basket type are fully described with complete load charts.

36 CARPULLERS

Superior-Lidgerwood-Mundy Corp.—A 24-page, 2-color bulletin C-616 "Carpullers for Easy Moving Rolling Loads" has just been issued, with descriptions, illustrations, data, tables and specifications for Carpuller requirements. Illustrates and describes the Electric Capstan Carpuller for car moving, barge moving, pipe bending or any haulage of similar nature; also Tugmore Capstans, Horizontal Head type Capstan Carpullers, Drum Type Carpullers, Friction Drum Type Carpullers, etc.

37 CAST IRON PIPE

U. S. Pipe & Foundry Co.—An 8-page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids. The newly developed Tyton Joint is simple, sturdy, and tight. Illustrations show details of joint and method of assembly.

38 CAST IRON PIPE, HYDRANTS AND VALVES

R. D. Wood Company—A general catalog has recently been issued providing full details of weights and dimensions of "sand spun" cast iron pipe and cast iron fittings. This catalog also features fire hydrants, gate valves and other products manufactured by this company.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

39 CEMENT LININGS AVAILABLE FOR SMALLER MAINS

The Centriline Corp.—The Centriline process for cement mortar lining water line in place which was restricted from 16 to 144-in. in diameter, now is available for use in 6 to 14-in. mains. This new adaptation of the Centriline process, which eliminates the necessity for excavations at laterals and corporation cocks, is described in an illustrated catalog.

40 CEMENT MORTAR LINING OF PIPE LINES

Pipe Linings—New catalog which describes three methods of applying cement linings to correct internal corrosion, restore maximum hydraulic flow and prevent further leakage—Tate Process for 4 to 16-in. dia pipe lines; Spunline Process for 6 to 16-in. lines; and Centriline Process for 16 to 144-in. lines. Includes specifications, diagrams and detailed discussions of purposes and results achieved by the respective methods.

41 CENTRIFUGAL PROCESS PUMPS

Aurora Pump Div.—Included in this booklet describing centrifugal process pumps, are illustrations, outstanding features such as vertical center-line discharge making the pump self-venting, typical performance curves, dimensions, selection charts, and a parts list.

42 CLAD STEEL BRIDGE BEARING PLATES

Lukens Steel Company—A discussion of the development of Lukens clad steel for bridge bearing plate applications together with a description of types of plates presently available.

43 CLAD STEEL EQUIPMENT

Lukens Steel Company—A description of the development and manufacture of Lukens clad steels including data on types of cladding, cladding thicknesses, testing, clad steel heads, fabricating clad steel and various clad steel applications.

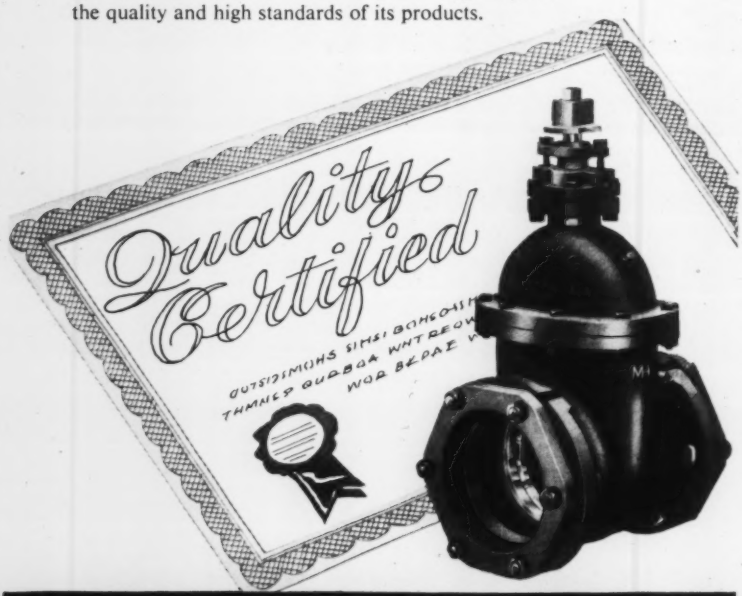
"WE CERTIFY"

M & H welcomes the suggestion of the American Water Works Association to certify the quality of products made to conform to current AWWA specifications. This is a matter of importance to the water works industry. For the present, the procedure is not completely resolved; nevertheless the program as such will reflect a valuable contribution to users of water works materials.

All M & H products listed as AWWA standard (either valves or hydrants) are made in strict compliance with latest AWWA specifications.

M & H products have been developed through many years of research in engineering, design, foundry practice and water works operation. This Company's greatest asset today is the confidence of engineers in the quality and high standards of its products.

MH



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

44 CLAY PIPE WARM AIR HEATING DUCTS

National Clay Pipe Mfgr., Inc.—A completely illustrated installation manual for underfloor slab duct heating systems is now being offered. This 2-color, 12-page booklet contains specifications, dimensions and detailed illustrations and plans for calculating and installing clay pipe warm air heating duct systems.

45 COAL RECOVERY DRILLS

The Salem Tool Company—Bulletin M-101, a four-page, two-color pamphlet describes coal recovery drills 16-in. to 42-in. in diameter for 12-ft long augers. Photographed are a heavy-duty barrel-type drill head 42-in. in diameter with tungsten carbide 3-prong pilot adjustable core burster, reinforced double auger flighting, barrel equipped with bug dust clearance spirals; and a 36-in. heavy-duty nut and slack drill head for drilling rock and producing nut and slack coal.

46 COFFERDAMS

Spencer, White & Prentis, Inc.—"Cofferdams," by Lazarus White and Edmund Astley Prentis is a trusted source-book covering actual design and construction of cofferdams as well as the theoretical features. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

47 COLORED DRAFTING PENCILS

J. S. Staedtler, Inc.—An interesting leaflet "Why Are People Intrigued With Mars?" contains information on the new Mars-Lumochrom colored drafting pencils which were designed with the needs of the draftsmen especially in mind. Reproduction is perfect throughout the entire 24 color range in which they are made so that they are well suited for drafting in color.

48 COMBINATION GRADER AND VIBRATORY COMPACTOR

Galion Iron Works & Mfg. Co.—Leaflet No. 424 describes how you can grade and compact with one machine. This unit is a combination of the Galion Model 503 Motor Grader and a Jackson Electric Vibratory Compactor. This combination will meet most density specifications for granular soil normally used for base and subbase construction.

49 COMBINATION VIEWER, ENLARGER & DEVELOPER

Ozalid Division, General Aniline & Film Corp.—Information on the Micromatic, a fully automatic viewer-enlarger-processor, which produces 18 x 24-in. working prints from unitized microfilm, is available. A single push button control activates the Micromatic which automatically delivers stabilized high quality prints to the operator in less than a minute. This combination microfilm reader, enlarger, and developer, selectively reproduces a paper print from the microfilm image on Actifilm, Ozacard, or aperture card up to $3\frac{1}{4}$ x $7\frac{3}{8}$-in.

50 COMMERCIAL LOCKBOLTS

Townsend Co.—The new literature on commercial lockbolts is well illustrated to show a wide variety of applications. Diagrams show how the lockbolts work and a special section is devoted to dimensions and specifications. Information on how to order, application procedures and pneumatic pull guns also is included in the $8\frac{1}{2}$ by 11-in. booklet.

51 COMPRESSION & FLEXURE TESTER

Forney's Inc.—Included in this 4-page brochure is a general description of the Model LT-600—375,000-lb capacity compression and flexure tester, together with paragraphs on hydraulic cylinder assembly, lower platen, upper machine platen, gages, and dimensions and weights. Also available is a pocket slide rule for instantly converting applied pressure into psi on a wide variety of specimens.

52 CONCRETE FINISHER

The Flexible Road Joint Machine Co.—Of special interest to contractors is an 8-page brochure entitled "Flex-Plane Combination Finisher-Float Machine." Some of its features include bogie wheel assembly which allows track wheels to move vertically without influencing elevation of the 16-ft straightedge platform formed by tying the 2 frames together; rear screen suspension; screed extensions, and spring-loaded screed ends. General specifications, typical applications of the machine, and illustrations are also shown.

Please give your complete address.

53 CONCRETE FORMING SYSTEM

Economy Forms Corporation—A catalog with pictures is offered showing a complete forming system available to contractors on a purchase basis. The easy adaptability of these forms to all types of form work, plus engineering layout service on each new project, together with a complete steel form good for a lifetime of service makes the new EFCO form an attractive investment for the large and small builder. Also available, a new four-page leaflet covering forms for prestressed or precast concrete beams, etc.

54 CONCRETE FORMS & ACCESSORIES

Universal Form Clamp Co.—has prepared a new 56-page catalog which illustrates and describes their complete line of concrete forms, form ties, accessories, construction specialties and highway products. The catalog makes a handy reference guide for anyone engaged in the forming of concrete.

NEW Everybody Needs This "Quick-N-Easy" CAR-TOP CARRIER

ON AND OFF IN MINUTES
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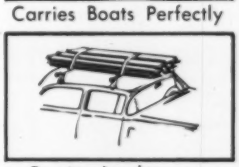
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Your Money Back If This Isn't the Greatest Carrier You Ever Used!

55 CONCRETE HANDLING EQUIPMENT

Gar-Bro Mfg. Co.—A new revised and profusely illustrated 36-page catalog 300A, containing specifications for more than 300 items of concrete handling equipment is now available. Serving as a job conditions and specifications guide, it features concrete buckets, chutes and hoppers, bucket attachments, powered crane hooks, carts, wheelbarrows, bins and batchers, paving vibrators, industrial wheels and other equipment.

56 CONCRETE INSTALLATION SERVICES

Intrusion-Prepakt, Inc.—Newly published 8-page reference bulletin describes special services pertaining to soil stabilization, foundations, mixed-in-place piles, cast-in-place piles, structural and marine concrete. Pertinent data will be supplied for all other problems. Well illustrated, plus specifications.

57 CONCRETE PRECISION BUMP CUTTERS

Concut Sales, Inc.—A 2-page catalog illustrates and describes the concut precision bump cutter which quickly and efficiently eliminates bumps from concrete and asphalt surfaces within the tolerance of ⅛-in. deviation in 16-ft. It also develops varying degrees of surface texture by adjusting the width of the spacers between the diamond blades.

58 CONCRETE PRESSURE PIPE

Price Bros. Co.—A revised 24-page book that explains and illustrates how prestressed concrete cylinder pipe is made, how the pipe is laid and the advantages of concrete pressure pipe; also includes the cut-away diagrams showing the construction of the various types of concrete pipe and the flexible, watertight joint. A table of types and sizes gives helpful information for selecting pipe.

59 CONCRETE REPAIR

Masonry Resurf. & Cons. Co., Inc.—"Iron Girdle Holds Concrete for Bridge Pier Repair" is a reprint illustrating the methods and techniques of "in the dry" repair of a 24-ft dia pier near Baltimore, Md. These procedures which revitalize deteriorated structures adding many years of useful life to an old structure are similar to those utilized in the "Dri-Por" system of pile repair. Many illustrations clearly show the work in various stages of repair.

60 CONCRETE RESURFACING

Portland Cement Association—This pamphlet is divided into two sections—design of resurfacing and construction of resurfacing. A few of the topics covered are: design of distributed steel, design of widening, design of concrete mixes, preparation of old slab, preparation for widening, and forms and form setting.

61 CONCRETE SAWING EQUIPMENT

Concut Sales, Inc.—A bulletin illustrates and describes the complete line of Concut Concrete Sawing Machines, Supreme Diamond Blades and Abrasive Blades. Included in the line is the Model R-85 Lightweight machine for sawing concrete up to 3-in. in depth, Model-S-200 Standard machine for sawing up to 5-in. in depth, the Self-Propelled Concut and the Jointmaster for large air base and highway sawing jobs.

62 CONCRETE STADIUMS & AUDITORIUMS

The Master Builders Co.—Case histories of the concreting operations on 16 outstanding stadiums and auditoriums in this country and abroad are presented in this new 20-page publication. Job stories cite the role played by Pozzolith in obtaining the workability necessary for heavily reinforced concrete members common to this type of structure. Photographs illustrate the outstanding beauty achieved with architectural concrete in many of these structures, and give evidence of the long-term, low-cost maintenance attained with Pozzolith.

63 CONCRETE TESTER

Soiltest, Inc.—A new 6-page bulletin on concrete testing machines and accessory equipment has been issued. Illustrated and described are a wide range of portable and laboratory testing machines for testing concrete cylinders, blocks, beams and similar construction materials. The machines range in capacity from 200,000-lb to 400,000-lb.

64 CONCRETE WATERSTOPS

Water Seals, Inc.—Labyrinth[R] Waterstops are manufactured of polyvinyl plastic, which helps maintain a constant, strong, watertight bond between concrete joints. A new catalog describes the convenient features of Labyrinth[R] Waterstops, including those which render it resistant to age, chemical and weathering changes. Blueprint type specification drawings include the Labyrinth, Flextrip, Cellular and Dumbbell waterstops in their various sizes. A table lists the recommended joint application and water head for each size and kind of waterstop.

65 CONCRETE WATERSTOPS—STANDARD & PREFABRICATED

Water Seals, Inc.—Labyrinth[R] Waterstops, manufactured of durable polyvinyl plastic, have the ability to maintain a constant watertight bond between concrete joints, are available in either fabricated form for special application or in standard linear form. A new catalog describes the recommended applications for each of the various types of waterstops, including maximum water heads, specific joint applications.

In filling out the coupon, please print clearly and be sure that you furnish a complete address.

66 CONSTRUCTION EQUIPMENT

Seaman-Andwall Corp.—has issued a catalog covering their complete Sta-Bilt line of construction equipment. Illustrated and described are the Pulvi-Mixer, Trav-L-Plant, Steel wheel, and pneumatic self-propelled rollers, materials spreaders, rock breaker and the Vibro-Joint cutter for making contraction joints in concrete paving.

67 CONSTRUCTION MATERIALS

Texas Vitrified Pipe Company—A comprehensive, 32-page catalog lists complete Tex-Vit line of vitrified clay pipe, clay pipe fittings, glass-lined clay pipe, bituminous and plastic "Jiffy-Joints" for clay pipe, Wedge-Lock plastic joints, channel pipe, perforated pipe, translot filter blocks, flue lining, chimney pipe and fittings, flue rings, fire brick, fire clay, clay pipe heating and ventilating ducts, wall coping and related clay products. Useful reference material also is included.

68 CONTRACT PUMPING

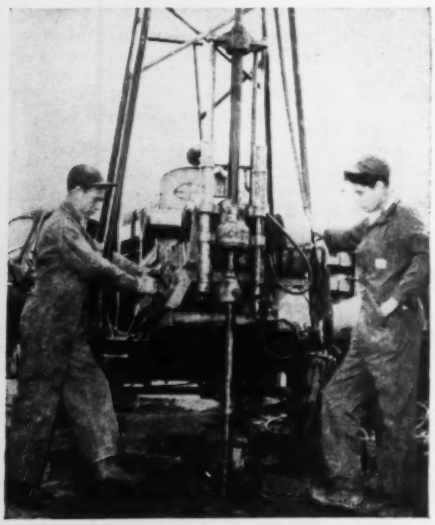
American Dewatering Corp.—A well illustrated catalog describing the predraining of many construction projects of typical and unusual interest. Outlines the services and benefits of contract pumping in which this company specializes.

69 CORRUGATED STEEL FLOORING

Armco Drainage & Metal Products, Inc.—Manual BP-8455 describes Armco bridge plank for new or existing bridges and grade separation structures. The material restores safe strength to old structures; stiffens bridges laterally; eliminates rattles; adds little or no dead weight; is installed quickly at low cost; and requires no special maintenance. Engineering details and design data are given, with recommended installation practice. Another section shows a photo record of two typical bridge plank installations.

acker core drills

do the "underground work" wherever highways are underway!



Contractors FROEHLING & ROBERTSON, INC., of Baltimore own the trailer mounted Acker TH Core Drill shown above. It is doing test boring for the new Cumberland Highway.

Wherever highway construction is underway, you will find Acker Equipment engaged in "underground" exploration work.

And, there's good reason!

Acker Rigs are compact, dependable and ruggedly built. Like the Acker TH Core Drill pictured, they can be furnished completely self-contained with water pump, derrick, cargo-type winch, choice of power plant and mounting on trailer, truck or jeep.

For the complete story on why Acker Core Drills are preferred by leading contractors and engineers, please write for Bulletin 30. CE

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Over 40 years of experience manufacturing a complete line of diamond and shot core drills, accessories and equipment.

CATALOG DIGESTS

70 COST DATA

Barco Manufacturing Company—Of interest to earthmoving contractors is a bulletin of cost data for soil compaction in restricted areas. Specifications accompany the data.

71 COUNTERPOISE PIPE HANGERS

National Valve & Mfg. Co.—This 16-page booklet gives complete specifications for the entire line of hangers, engineering drawings of all models, weight-load selection tables, and erection and adjustment information. Counterpoise Hangers are designed to provide a constant load supporting capacity for piping systems subject to vertical movement caused by expansion and contraction of the piping with temperature changes. Navco Levelglide Hangers, which permit horizontal movement of piping systems, also are described in the brochure.

72 CRANE HOOK

Gar-Bro Manufacturing Co.—Information on the new Model B Crane Hook that opens and closes pneumatically and is trigger actuated has been announced. This heavy-duty hook, with a capacity of 12 tons, is especially designed for handling 2, 3 and 4-cu yd concrete buckets and is also useful for other lifting work. The crane operator simply lowers the hook so that the mechanical trigger within the hook circle contacts the bucket bail, which actuates the ratchet type air valve that controls the opening or closing of the hook. Overlapping lifting tongs provide an important safety factor; the hook cannot open under any load.

73 CRAWLER TRACTOR

International Harvester Co.—The 55.7 drawbar hp International TD-9 diesel crawler tractor is described in detail in a new 16-page catalog (Form CR-629-H). In addition to the full description of the various components of the TD-9, a complete line of matching equipment and attachments are shown.

74 CURB AND GUTTER LAYING

E. L. Hardin Associates, Inc.—Literature is now available describing the Smith-Field Automatic Curb & Gutter Machine for laying integral curb and gutter without forms or hand finishing and the Stephens-Canfield Automatic Curber for faster curb laying without forms and using asphaltic or Portland cement concrete. On-the-job photographs show these machines in action. Complete specifications and data are included in the new literature.

75 CURTAIN WALL

H. H. Robertson Co.—This booklet contains a description of Versatile Wall—the curtain wall that offers complete design versatility with standard components. Robertson's grid system conforms to any module and offers an infinite variety of colorful metal panels, including porcelain enameled aluminum with trim. Single or double glazing, with any type of operating sash.

76 CURTAIN-WALL DATA

The William Bayley Co.—Aluminum and steel curtain-wall systems and window-wall systems are the subject of a new data reference file. Included in the file are three brochures with specifications and detailed information, that give diagrams, detailed illustrations, and other specification data essential in specifying the various window or curtain-wall systems.

77 DEPTHOMETER, CAMERA, LOCATOR

Bludworth-Marine—Literature describing the new single transducer survey depthometer ES 130, which is portable, weighs under 40-lb and performs with great flexibility and precision, is now available. Also provided is information on an underwater TV camera with a continuous picture on monitor screen on boat or land, with depths to 180-ft; and a metal locator which pinpoints ferrous and non-magnetic metals in fresh and salt water. Pressurized to depths up to 160-ft, this locator weighs 1½-lb submerged.

Turn to page 134 and order your literature.

Architects: Weed, Russell, Johnson and Associates
Engineers: Norman Dignum and Associates
General Contractors: Arnold Construction Company

Vibroflotation®

was used to compact the sandy subsoil for foundations — eliminated the need for piling — at West Palm Beach, Fla.

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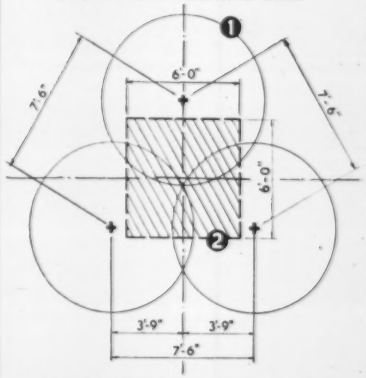

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V-14

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78 DESIGN MANUAL

W. R. Meadows, Inc.—has prepared a manual entitled "Design Techniques for Controlling Moisture in Building Structures." This manual, prepared by a firm of technical engineering writers, was originally planned to sell for $1.00 per copy. However, as this problem is of vital interest to all in the construction industry, this company will now send a free copy to all architects, engineers and builders who desire a copy for their file.

79 DIGESTERS & FLOATING COVERS

Infilco Inc.—Bulletin 6700 offers information on high rate and conventional rate digestion equipment. The VCZ digester provides tank turnovers up to 20 times per hour by use of the Vorti-Mix^R circulator, the most efficient pumping machine now offered to the waste treatment engineer. Three or four tank turnovers per hour are effected in the VCZ digester.

80 DIRECT READING LEVEL ROD

Lenker Mfg. Co.—According to a newly published pamphlet, the direct reading level rod eliminates all computations for engineers, contractors and builders. As the numbers on the rod read from top to bottom, all readings are elevations. A picture of the rod, full description and operation procedure are included.

81 DOCKS, WHARVES AND MOBILE DRILL BARGES

DeLong Corporation—A 20-page, profusely illustrated booklet describes the DeLong method of installation of prefabricated docks, wharves and other structures including mobile offshore drill platforms raised by means of the DeLong Jack. Also describes the famous Texas Tower project, a mobile aerial cableway system and other commercial and military installations.

82 DRAFTING EQUIPMENT

Eugene Dietzgen Company—Some of the products described in this 208-page illustrated catalog are: drawing boards, moisture proof tracing cloth, graph sheets, triangular scales, slide rules, drafting tables and sectional filing cases. A price list is included.

Return the coupon today!

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THE COMPLETREATOR

This D-O CompleTreator unit is serving a recreational facility at Freestone Point, Virginia.

Now . . . for the first time . . . complete sewage treatment for a population equivalent of 150 persons *in a single unit*. The CompleTreator unit consists of a Dorr Duo-Clarigester surrounded by two stages of high rate trickling filters and two recirculation pumps in respective wells. Solidly based on well-known and proven sanitary engineering principles and methods, the CompleTreator has the outstanding advantage of incorporating in a single unit those processes which previously required five separate tanks. Using the two-stage Biofiltration flowsheet with separate sludge digestion, average daily capacity is 15,000 gallons; and where normal domestic sewage is being handled, a treatment efficiency of 90% BOD and suspended solids removal can be realized. The CompleTreator is ideally suited for housing developments, restaurants, service stations, motels, schools, military installations and domestic type wastes from industrial activities.

For additional information on the Dorr-Oliver CompleTreator, write Dorr-Oliver Incorporated, Stamford, Conn., for a copy of Bulletin No. 7315.

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83 DRAIN GRATES

Irving Subway Grating Co., Inc.—A recently published four-page, two-color folder illustrating the use of open mesh steel flooring as drain grates is now available. The folder contains photographic illustrations and shows typical uses of drain grates. There are engineering drawings of the various types and complete technical data to facilitate estimates and specifications.

84 DRAWING INSTRUMENTS

Fennel Instrument Corp. of America—This firm offers a new line of drawing instruments for architects and engineers. Packaged in colorful simulated leather cases, these instruments are made by Maho, one of the finest companies in West Germany. New literature is available describing the line which is complete from flat and square types for the professional down to the inexpensive school set.

85 DREDGE PUMPS

American Manganese Steel Div.—Besides specifications and a cross-section of the Amsco Dredge Pump, this booklet contains information on its important features, such as heavied-up metal thickness of the high-wear areas which prolongs the life of wear parts; threaded shaft for easy attachment to the impeller; and utilization of a removable block with slotted flanges, to aid in changing shells.

86 DRILL PRESS CLAMPS

Termite Drills, Inc.—Form 553-7 illustrates and describes the Sta Put Drill Press Clamp. Sta Put is the most practical device for holding almost any shaped article secure for easy, accurate drilling and fits all drill press column diameters. A split collar makes it easy to attach. It swings out of the way when not in use. Sta Put reduces drill breakage, spoilage of expensive material and the danger of broken fingers and skinned knuckles.

87 EARTH TAMPER

The Jay Co.—Outstanding features of the Jay Tamper are: portability which makes it a natural for street, highway, and airport maintenance crews; no giant cumbersome, expensive piece of rolling or compressor equipment is needed; and tamping next to abutments is no problem.

88 ECONOMICAL MAINTENANCE OF WAYS & STRUCTURES

Caterpillar Tractor Co.—Effectiveness of Caterpillar-built machines in railroading is discussed in a new booklet which describes Caterpillar equipment at work on railroad way maintenance on different United States rail lines. Illustrated with on-the-job photos, the brochure shows maintenance under work-a-day and disaster conditions. Versatility, economy and service availability are emphasized by the job reports included. A list of equipment and a map of service points along the main lines are also in the booklet.

89 ELECTRONIC COMPUTER

Royal McBee Corp.—The LGP-30 Electronic Computer is described in a 4-page pamphlet, S525, as a general-purpose digital computer which fulfills the need for a small-sized reliable and low-priced scientific computing device. Its range of calculations and the scope of its applications is almost limitless. It has a relatively simple command structure, a magnetic drum memory which holds 4096 words, and a simplicity control panel which allows the operator to concentrate on his problem rather than on the operation of the machine.

90 ELECTRONIC COMPUTER

Royal McBee Corp.—This is a 10-page booklet, S-526, which contains applications, operations and specifications of the LGP-30. It is a fuller treatment of the computer than the 4-page product pamphlet. It gives an explanation of commands, suggested uses in industry, and general specifications.

CATALOG DIGESTS

91 ELECTRONIC DISTANCE MEASURING

Tellurometer, Inc.—General descriptive and technical literature is available on this new radio micro-wave distance-measuring equipment now being used extensively by government and commercial survey agencies. The Tellurometer is capable of high accuracy on either day or night work, in fog, rain, or snow. It is rugged, readily portable, battery-operated and has built-in radio telephone communication. Costs are greatly reduced on traverse, trilateration, hydrographic, pipe line, off-shore location, picture-point, oil, mine, base line, highway, and other field survey operations.

92 ELEVATED TANKS

Pittsburgh-Des Moines Steel Co.—Details of the several different types of elevated steel tanks, including capacity, ranges, tank dimensions, and other factors to be considered in the selection of storage tanks. Also available, 4 pages of pictures and discussion about flat bottom water storage.

93 ENSLAG COLMIX

Vulcan Materials Co.—A bituminous paving mixture that may be laid cold. Specifications and technical data included in a new 8-page booklet. Of particular interest are results of tests undertaken by various state and government agencies, which prove the superior skid-resistant characteristics of blast furnace slag, the aggregate contained in Enslag Colmix. Pictures show actual application. Charts and text outline the varied uses for this versatile paving material.

94 EQUIPMENT FOR ELECTRICAL GENERATING PROJECTS

Pacific Coast Engineering Co.—The purpose of this brochure is to picture and briefly describe equipment used for electrical generating projects which includes cranes, gates, hoists, penstocks, pipe valves, and other units requiring engineering design and skilled fabrication and machining of heavy plate. Large, clear illustrations are included.

95 EXCAVATOR

Harnischfeger—40-page fully illustrated booklet describes in detail the Model 1055 Excavator. Some of the outstanding advantages of this equipment are "magnetorque" electric swing, low pressure hydraulic control, high tensile rolled steel construction, extra cable capacity and full vision cab. Many large-size "on the job" pictures are included.

96 EXPANSION PLATES & BUSHINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 55 contains complete information, technical data, and specifications about self-lubricating expansion plates and bushings for bridges, buildings, refinery equipment and chemical processing equipment applications.

97 EXPOSED CONCRETE AGGREGATE

Sika Chemical Corp.—This 4-page brochure describes two ways of obtaining exposed concrete aggregate during construction. This exposed aggregate can serve as a bonding surface at construction joints or have a decorative architectural effect. On horizontal surfaces, Rugasol-C, Retardant Concrete Coating is applied directly on the freshly placed concrete. On vertical surfaces, or precast panels, Rugasol-F, Retardant Form Coating, is applied on the forms before or after erection.

98 EXTRUDED GRATING

Washington Aluminum Co., Inc.—An eight-page booklet in color describes the many uses of gratings and treads of aluminum. Extruded grating is a most versatile product since its various depths, and punchings make them suited for marine industrial and commercial applications. Specifications and a safe tread table are included.

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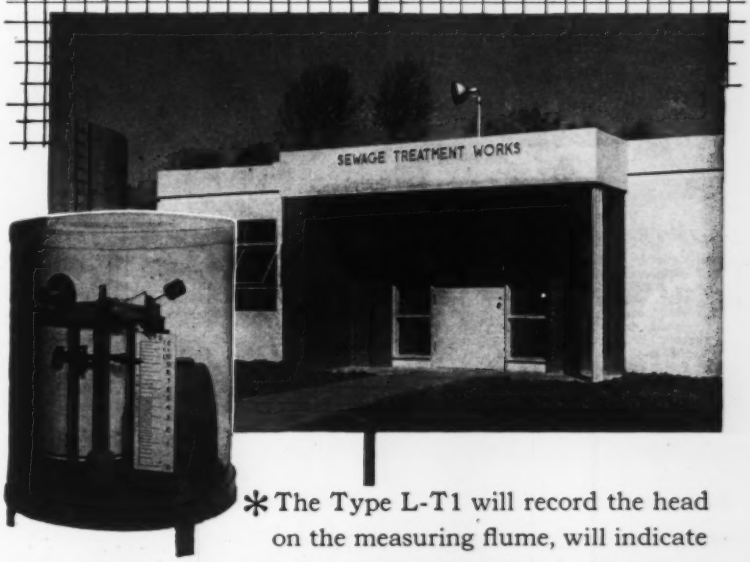

*The Type L-T1 will record the head on the measuring flume, will indicate the volume of flow for any time interval and will give an instantaneous reading of the rate of flow. The head record, made on convenient rectangular coordinates, is basic information for permanent record from which plant operators and State Sanitary Engineers can check flows and volumes. The volume reading from the totalizer dials and the rate of flow indicator are essential for intelligent operation. Readings can be made in any desired volume and flow units.

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99 FASTITE JOINT PIPE

American Cast Iron Pipe—This new, illustrated 12-page brochure describes the advantages of the new double-sealing single gasket type joint. The booklet contains instructions for assembly, weights and dimensions, and typical installations of the pipe for water, sewage and other liquid service.

100 FIBRE FORMS

Sonoco Products Co.—Uses of Sonotube, fibre forms, are illustrated in a brochure. These fibre forms provide an economical method of forming round, obround, half-round and quarter-round columns. Also encasement of steel and wooden piles, existing columns and utility risers. Available in several different types, the newest which provides a form surface requiring little or no rubbing of the finished column. Technical data also available.

101 FIBRE TUBES

Sonoco Products Co.—Sonovoid, fibre tubes, were specifically developed to form voids in bridge decks; wall, floor, roof and lift slabs and in concrete piles. Uses illustrated in a brochure. Sonovoid, fibre tubes, are used in precast or cast-in-place units of conventional or pretensioned construction. Tie down and spacer method shown along with design data for 8-in. and 12-in. slabs. Other technical data available.

102 FIELD EQUIPMENT

Warren-Knight—Part 1 of two brochures concerning Engineering Equipment & Supplies, has been published. Entitled "Field Equipment" this booklet includes write-ups and photographs on transits and levels, compasses, measuring tapes, spring joint rules and survey markers. Paragraphs concerning instrument care and repair are included in this 24-page booklet.

103 FILTER MEDIA

Anthracite Equipment Corp.—A bulletin on "Anthrafilt" tells the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Information about a free technical advisory service is included.

104 FIR PLYWOOD DIAPHRAGMS

Douglas Fir Plywood Assoc.—A completely new publication on Fir Plywood diaphragms has just been released. Written by engineers for engineers, it is an easy-to-use, handy-to-file, 10-page folder describing the importance and function of diaphragm construction, the advantages, how they are designed and their comparative cost. Suggested specifications are also included.

105 FLEXIBLE ASPHALT LININGS

Envoy Petroleum Co.—The licensed West Coast manufacturer of flexible molded asphalt panel linings has available a manual which describes the material and its uses. Also, included are typical installation procedures and pictures of some of the many installations. Ideal for domestic water supply, industrial and irrigation facilities, "Panelcraft" linings are used in new reservoirs and canals as well as in relining existing structures.

106 FLOOR ARMOR

Irving Subway Grating Co., Inc.—Recently published 24-page color catalog on Gridsteel floor armor. Gridsteel is made of steel bars on edge, bent and joined together in a continuous hexagonal mesh pattern. Floors armored with Gridsteel last indefinitely. Gridsteel prevents ruts or potholes from forming, gives an even, tractional floor surface at all times. Catalog illustrates uses, advantages, and shows how quickly and simply Gridsteel is installed.

107 FOUNDATION CAISSONS & PILES

Franki Foundation Co.—An interesting, informative and well illustrated brochure describes in detail the Franki method of installing Displacement Caissons and Pressure Injected Footings. Caisson load test results on representative projects and reinforced concrete cap design data are noted. Various types of pile foundations installed by Franki are indicated.

108 FOUNDATION PIPE

L. B. Foster Co.—Comprehensive information of spiralweld foundation pipe piles is presented in a new 24-page booklet. In addition to detailed specifications, the photo-illustrated brochure describes a number of pipe pile installations and includes typical driving logs. A special feature is a table giving complete specifications of all popular pile hammers, including new diesels.

109 FREE TURQUOISE TEST KIT

Eagle Pencil Co.—This kit contains a Turquoise pencil, Turquoise lead, and an amazing specially created "lead skelton". It also features pictures taken with an Electron Microscope which shows, under 7500 magnification, the startling difference between Eagle's "Electronic Turquoise lead and the lead in the usual high quality drawing pencil.

110 GEARS

The Earle Gear and Machinery Company—A twenty-page catalog describes in general, the kinds and sizes of gears manufactured by this company. Its contents deal with spur gears, bevel gears, helical gears, worm gears, racks, non-metallic gears, sheaves, sprockets, special machinery of which gears form a part, and special gear information. Illustrated with photographs, it also shows actual Earle installations.

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CATALOG DIGESTS

111 GRADLINE SURVEYING STAKE

George E. Long Co.—Some of the advantages of the Gradline Surveying Stake listed in a new pamphlet are: elimination of the necessity of driving a wood hub exactly on line and station; errors in grade or line can be easily seen and corrected; and the stake can be driven by an air or electric tool.

112 GRATING FLOORING AND TREADS

Irving Subway Grating Co., Inc.—General Grating Catalog F400 contains illustrations, descriptions and complete engineering data on grating flooring, treads and floor armoring (riveted, press-locked, welded types). Irving Grating is safe, durable, fireproof, ventilating, clean and economical for industrial and power plants and refinery walkways, stairways, driveways, trucking aisles.

113 GRATINGS

Borden Metal Products Co.—A 16-page catalog shows the three basic types of grating construction; more than 30 dimensional drawings of subtypes; eight safeload tables covering steel and aluminum gratings, roadway grating and sidewalk slabs plus other tables on panel widths, tread widths, floor armor, etc. Also shown are the various safety treads and their nosings. Included are the steps for careful planning and checking of the job.

114 GRIT COLLECTING & WASHING EQUIPMENT

Link-Belt Company—This 28-page brochure deals with grit collection and washing equipment. Some of the subjects are: design data —methods of design, factors and charts; straightline grit collector Type S; straightline Grit Washer Type SW—a separate screw to wash and dewater grit conveyed to it by pump, ejector, air lift or mechanical means; and Tritor Screen— a combined grit collector and mechanical screen for economical design at small plants.

PLEASE PRINT
NAME CLEARLY.

115 GUARD RAIL

Granco Steel Products Co.—A product manual contains 8 pages of application photographs, standard drawings, specifications, curving data, installation instructions and facts on non-highway use of the new Granco deep beam guard rail for highways and bridges. Corrugated from tough carbon steel to act as a continuous impact-resistant beam, its inherent characteristics and engineered features provide hi-strength visual barrier, greater safety, no pocketing, interchangeable sections and economy.

116 GUNITE

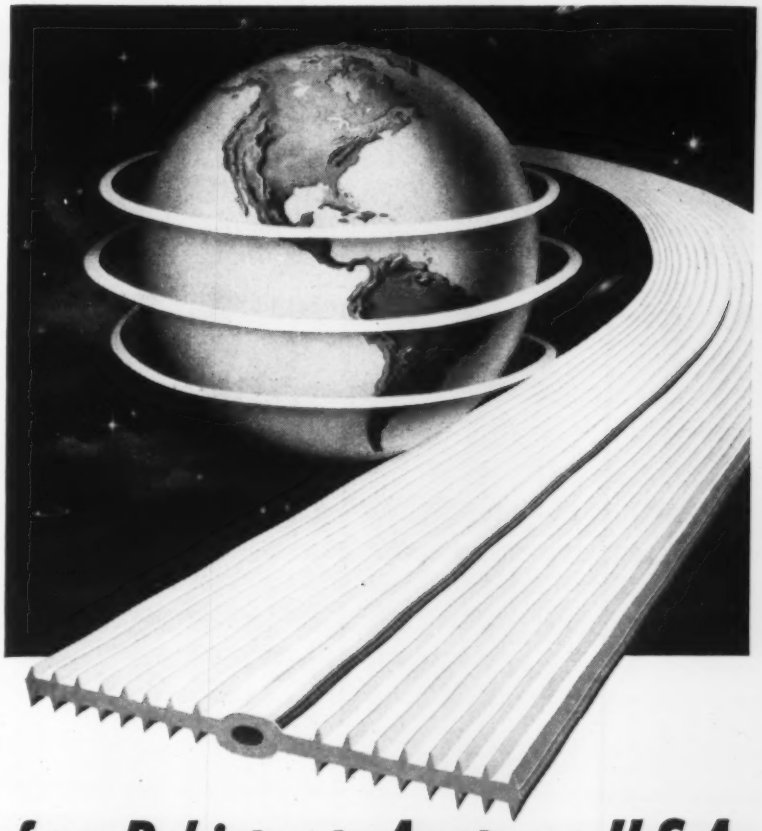
Pressure Concrete Co.—Gunite in all phases is described and illustrated in a 48-page booklet which contains complete specifications. Illustrations show Gunite repair of reservoirs, dams, filter plants, sewage disposal plants, stadiums, bridges, stacks and bunkers. The booklet also contains photographs on new prestressed tank construction and other data. A new leaflet just published illustrates pressure grouting to dams.

117 HEAVY DUTY TRAILERS

Birmingham Manufacturing Co., Inc.—This revised Catalog "E" covers the standard line of lowbed trailers through 75-tons, complete with dimension sketches and photographs of all the models and accessories. It also has a section on jeep dollies, telescopic trailers, trailer trains up to 265-tons and many other special applications in the heavy duty field.

118 HIGH-CHROMIUM CAST IRON

American Manganese Steel Div.—The subject of this 4-page booklet is a high-chromium alloy iron which is made especially for severely abrasive and corrosive pump applications. It eliminates many of the undesirable variations in wear life sometimes experienced with other alloyed cast irons because it is uniformly produced under highly controlled foundry conditions, chromium carbides are used to give outstanding abrasive wear resistance involving low to medium levels of impact and small to medium size abrasive particles, and it has high hardness—400-600 BHN.



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SEAMLESS SONOTUBE® a premium form specifically developed for use where exposed finished columns are desired.

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SONOCO Construction Products

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1497-A

CATALOG DIGESTS

119 HIGH STRENGTH STEEL DESIGN MANUAL

United States Steel—The first complete text on how to design high strength low alloy steels. Concise, well-written, it covers unit stresses, beams and columns, plates, riveting and designing to thwart corrosion. Probably the only basic text extending design fundamentals to the higher strength levels of high strength steels.

120 HORIZONTAL SHORING

Spanall of the Americas, Inc.—Now available is a revised edition of the 8-page catalog on the subject of Spanall, registered trade name of pre-stressed, all-metal horizontal shoring for all types of beam and slab concrete floor forms. The new catalog contains complete engineering and application data, supported by isometric drawings, charts and photographs illustrating typical installation techniques.

121 HORTONCLAD—COMPOSITE METAL

Chicago Bridge & Iron Co.—A 32-page booklet describing the manufacture of Hortonclad, a composite metal—produced by a flux-free, high strength vacuum bonding process—having an integral and continuous bond between an alloy or special metal and its backing plate. The publication explains the process developed by the company to produce Hortonclad. It also lists a variety of cladding and backing metals and outlines CB&L's research, design, fabrication and erection facilities, including field stress relieving and field X-raying. A number of Hortonclad structures are illustrated.

122 HOT WEATHER CONCRETING

Sika Chemical Corp.—Complete information on controlling the set of concrete during hot weather is available. Test data, specifications and technical information on Plastiment Retarding Densifier are included.

123 HOUSE ORGAN

Graver Tank & Mfg. Co.—The Echo, house magazine of Graver Tank & Mfg. Co. offers an interesting cross-section of the type of steel and alloy plate work which Graver fabricates in its five plants and erects in the field. The current issue of this magazine describes an elevated water tank for a municipality, an alloy tower for industrial gases, fuel oil tanks for a shopping center, and gasoline and crude oil tanks. Articles on Graver's centennial round out the publication.

124 HOW TO CORE DRILL

Acker Drill Co., Inc.—"Basic Procedures of Diamond and Shot Core Drilling" shows with over 80 illustrations and drawings the fundamentals of core drilling practice. Pipe driving, core recovery, core logging and storage are all covered in this pocket size book for the beginning driller. The price is $1.00.

N. B. There is a charge for this book. Make checks payable to Acker Drill Co., Inc.

125 HYDRAULIC LOADER

American Road Equipment Co.—A new booklet is available which describes the Econmobile 600 hydraulic loader. Bigger, more rugged, and more practical than ever—it handles masonry units from truck to scaffold. With a wide range of attachments, the machine is so versatile that some contractors have reported a 90% use factor in doing such jobs as loading aggregate, pouring concrete walls, erecting structural units, and charging portable patchers. Illustrations of attachments are included.

126 HYDRAULIC TURBINES

The James Leffel & Co.—Details on the turbines which drive both power generation and pumping units at the United States Bureau of Reclamation, Chandler Power and Pumping Plant, are given in a 12-page Bulletin 1098-E. Descriptive literature on other recent turbine installations will be inclosed.

There are 299 Digest items on pages numbered 134 to 163. Read all items for the literature of interest to you.

CATALOG DIGESTS

127 IMPROVED AERIAL BRIDGING

Hycon Aerial Surveys, Inc.—Of interest to any engineer concerned with mapping, is a new bulletin called "Improved Aerial Bridging Through Automatic Computation" by R. S. Brandt and James Gimlett. The paper describes stereotriangulation, and the old and new method of adjustment. The system has wide applicability in that it can be extended to any problem where a large volume of measurements and complex mathematical transformations are involved.

128 INSTRUMENTS

Filotecnica Salmoiraghi—Presents an attractive general catalog, a complete line of revised instruction manuals and descriptive pamphlets covering each of the F/S instruments advertised in "Civil Engineering": Optical Theodolites; Conventional and Self-Leveling Levels; Planimeters, etc.

129 JETTING PUMPS

Griffin Wellpoint Corporation—A booklet illustrates jetting pumps for pile and caisson jetting, oil pipe line testing, water supply and fire protection. The illustrations show unusual set-ups for high-pressure jetting, including parallel and series pumping arrangements.

130 JOINT SEALER AND WATERSTOP

Sika Chemical Corp.—A brochure describes the four new consistencies of Igas Joint Sealer. The stiffer consistencies are used for water reservoirs, swimming pools, tunnels and deep basements. Lighter consistencies are used where there is no actual water pressure such as joints in metal building panels. Specifications and architectural details are included.

131 JOINT SEALING COMPOUND

Servicised Products Corp.—Offers its revised up-to-the-minute brochure on Vertiseal, a two-component rubber type cold-applied self-vulcanizing joint sealing compound which can be applied to both vertical and horizontal joints. Available in three types—black, white and gray.

132 JOINTS FOR VITRIFIED CLAY PIPES

National Clay Pipe Mfg.—Five tested methods for joining vitrified clay pipe are described in a new bulletin now offered. This 2-color, 4-page bulletin gives instruction for jointing hot-poured bituminous, plastisol, pre-cast bituminous, mortar, and pressure joints. Information on preparing trench beds and backfilling is also included.

133 KODAGRAPH REPRODUCTION MATERIALS

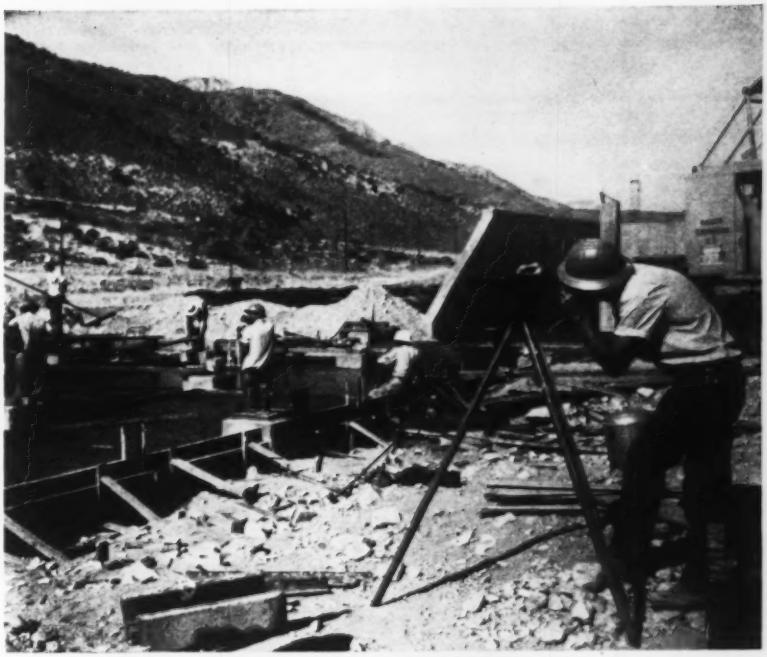
Eastman Kodak Company—This brochure describes all Kodagraph materials available for the preparation and reproduction of engineering drawings and documents. Of special convenience to the user of these materials is a two-page materials selection chart designed to help in selecting the Kodagraph film and paper best suited to any job. The original to be reproduced is matched with the equipment to be used in this fully-illustrated chart.

134 KOMPACTOR

Buffalo-Springfield Roller Company—Some of the profitable new features listed in this illustrated booklet on the Model K-45 Kompactor are: torque proportioning type differential, fast action instruments and controls, rugged front axle assembly and massive, all-welded frame.

135 LARGEST HIGHWAY SIGN PROGRAM

Federal Sign & Signal Corp.—Information is now available on the largest, single, unified highway sign program in the nation. This write-up states that more than one million dollars worth of all-aluminum highway signs, supporting structures, and road markers are being constructed. Some 4,000 dark blue and dark green signs with intensely reflective letters, and employing a number of highway sign advances, will guide motorists on the new highway, and its many interchanges and four-leaf clover intersections.



Kaiser engineer sights through Berger 18" Dumpy Level under blistering desert sun on the site of Permanente's plant, designed to turn out 2,400,000 barrels of cement yearly.

Kaiser Engineers tell how

BERGER INSTRUMENTS beat desert sand and heat

Brutal climatic conditions were the order of the day, *every* day, during the construction of the huge Permanente Cement Company plant at Lucerne Valley, California. Yet, the job called for close tolerance measuring in layout of buildings and placement of machinery.

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Layouts for mill building, primary crusher, burner building and clinker cooler foundations were all done with Berger Instruments. Rough grade tolerances were held to .01 ft., base plates and equipment foundations to .007 ft. Two 12 ft. by 450 ft. rotary kilns, among the world's largest pieces of moving machinery, were installed with the aid of Berger Instruments.

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CATALOG DIGESTS

136 LIFTING INSERTS PRECAST CONCRETE

Richmond Screw Anchor Co., Inc.—A new line of lifting inserts for precast piles, beams, slabs, columns, tilt-up walls and prestressed girders is described in a sixteen-page booklet just published. Complete data, working loads and ultimate strengths are given for each item in concrete of different strengths. Summaries included give pertinent information and results of all tests. Photographs and line drawings show details of application.

137 LIGHTWEIGHT ACKER PACKSACK CORE DRILL

Acker Drill Co., Inc.—will send to interested readers a copy of their Bulletin 1000 which describes their lightweight Acker Packsack Diamond Core Drill. The new drill can be powered by either an air motor or gasoline engine. The gasoline engine drill weighs only 32-lb and will drill a ⅞-in. core to depths of 100-ft. It is ideal for preliminary sub-surface work.

138 LIGHTWEIGHT PIPE & COUPLINGS

Naylor Pipe Co.—Bulletin 507 illustrates and describes spiralweld pipe for construction uses. Push-pull ventilation, high and low pressure air and water lines, dredging pipe, etc. in diameters from 4 to 30-in. It includes standard fittings, welding flanges, and data on one-piece Wedgelock coupling for fastest positive connection.

139 LIGHTWEIGHT SHEET PILING

L. B. Foster Co.—A new brochure lists specifications and uses of lightweight steel sheet piling for protecting light-load excavations. Because of its box-type corrugated design, the interlock of lightweight sheeting cannot jam. It locks rigidly when installed, but comes apart easily. The literature shows how the piling, which can be rented or bought, can be reused repeatedly. Typical applications are shore protection, sump pits, sewer trenches, bulkheads, cofferdams, and building excavations.

140 LIMI-TORQUE CONTROL

Philadelphia Gear Works—28-page catalog L-550, gives background information on this automatic, power activated device for controlling all types of valves and sluice gates. It describes the available types and lists specific applications. Installations are shown in power plants, refineries, and in various industries.

141 LINING IRRIGATION CANALS

Portland Cement Association—Some of the topics contained in this 34-page illustrated booklet are: general design considerations; shotcrete linings; soil-cement linings; economics of canal lining; and other uses of concrete in irrigation. A bibliography is included.

142 LIQUID FLOW RECORDERS

Leupold & Stevens Instruments, Inc.—Bulletin 25, Sixth Edition describes new models of Stevens Type B Series Recorders for graphic recording, totalizing and indicating liquid flow. Both direct float operated and remotely controlled instruments are described.

143 LONGSPAN JOISTS

Haven-Busch Co.—A 32-page catalog describing the new longspan series joists SJI-AISC and includes Top Chord Extension graphs, maximum moment table, load-carrying tables, panel dimensions, and other pertinent design data.

144 LONG SPAN M-DECK SECTIONS

The R. C. Mahon Co.—Included in this illustrated booklet about M-Deck Sections are specifications, construction details, engineering data and description. According for the pamphlet, all sections are roll-formed. They consist of a flat plate with two roll-formed hat section beam members welded to it to produce a Cel-Beam Structural Unit capable of spanning up to 33-ft with normal roof loads.

145 MAPPING PRODUCTS

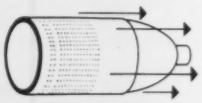
Fairchild Aerial Surveys, Inc.—A quick reference guide to Fairchild mapping products show the materials and methods for producing different types of maps. Included are oblique and vertical photos, photo index and line index, controlled mosaic or photomap, topographic contour map, Magnetometer contour map, and radioactivity contour maps and strip chart.

146 MASONRY DRILLS

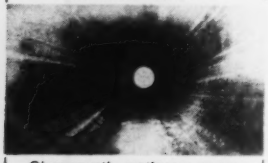
Termite Drills, Inc.—A recent catalog describes the complete line of Termite Carbide Tipped Rotary Masonry Drills. These drills feature nitride hardening which extends drill worm life at least 500 percent over drills that are not hardened. Prices and drilling recommendations are given.

147 MEASURING FLUMES

Thompson Pipe & Steel Co.—Four pages of tables on Free-Flow discharge for Parshall Measuring Flumes up to 20-ft throat width are included in the catalog describing this all-steel product which provides accurate measurement of water and fluids in open channels and ditches for irrigation systems, water works, sewage and industrial plants. They are also made of stainless steel and aluminum.



Liner compresses cement mortar onto interior



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HYDRAULICS TRANSLATIONS

To avoid duplication of effort and to bring the hydraulics engineer a definitive list of available translations of literature on hydraulics, the Committee on Research of the Hydraulics Division has prepared "A List of Translations of Foreign Literature on Hydraulics." This material is available as ASCE Manual 35—the latest of a renowned series of authoritative publications on civil-engineering subjects. This Manual can be ordered by clipping this coupon and remitting as indicated below.

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148 MECHANICAL DRAWING EQUIPMENT

Eberhard Faber Pencil Co.—A full color descriptive catalog sheet illustrating Microtomic mechanical drawing pencils and leads; wood-cased drawing pencils and engineering erasers has been made available. Three different types of erasers are described—No. 521, Race Kleen plastic eraser; No. 101, Pink Pearl; and No. 6002, Rubkleen.

149 METERS, FEEDERS, CONTROLS

B-I-F Industries, Inc.—This catalog provides a general coverage of equipment made by this company and its divisions. Photos of equipment as well as installation photos and brief descriptions of many products including flow, level, and pressure or temperature meters, liquid and dry material blenders, diatomaceous earth filters, liquid and dry feeders, control equipment and apparatus, and equipment accessories are included.

150 MICROFILM CAMERA

Ozalid Division, General Aniline & Film Corp.—Information on the MT/O 35-mm microfilm planetary camera for high speed and error proof production is now available. Automatic exposure control of the MT/O compensates for variations in voltage as well as background density and gives the exact exposure time which results in high fidelity microfilm of even density. This eliminates the need for light meters, voltage controls and other special engineering camera accessories.

151 MOTOR GRADER

Allis-Chalmers Co.—Working advantages provided by the Model Forty Five Motor Grader are covered in a 16-page, 2-color catalog. Photographs, sketches and other instructive illustrations aid readers to visualize details of the motor scraper's mechanical features and components. On-the-job photographs further assist in telling the performance, operating, comfort and service simplicity of the Forty Five. The catalog also tells about attachments and accessories that add to the versatility of the unit, and includes its specifications.

152 MOTOR GRADER

Galion Iron Works & Mfg. Co.—An informative 4-page bulletin on the Model 160 Motor Grader has just been issued. The heavy-duty, constant-mesh, six-speed transmission of this big 160-hp grader, as well as other operating and construction features, are fully described and illustrated. Complete specifications are included.

153 MULTI-PURPOSE TORQUE WRENCH

P. A. Sturtevant Co.—A new descriptive brochure is now available with information of a completely new approach to high torque application requirements. Now by using a conventional light weight, small size and low capacity torque wrench, a new series of adapters enables increasing the range of the conventional torque wrench as high as 900-ft-lb. A number of versatile combinations are available as standard stock items.

154 NEW T-16 OPTICAL TRANSIT

Wild Heerbrugg Instruments, Inc.—Many new design concepts are embodied in the T-16 Optical Transit, now available. The instrument is reportedly designed for ease and speed of operation. Circles are read at a glance to 1-min directly and to 20-sec by interpolation. A built-in repeating clamp is used for setting on zero and eliminates lower plate motions. A new optical plummet giving an upright image has also been incorporated in the T-16.

155 NEW WELL SCREEN

Layne & Bowler, Inc.—"The New Layne 134 Shutter Screen for Gravel Wall Wells", 6-page 4 color bulletin, describes the improved Layne Screen with data and specifications.

156 NON-SKID ABRASIVE LADDER RUNGS

Reliance Steel Products Co.—A four-page brochure describes the uses and advantages of Relgrit non-skid abrasive ladder rungs which last as long as steel and provide safe footing on ladders even when they are wet or oily. The booklet gives complete information with illustrations to help users determine their own applications.

157 OCT-O-DUCT

Soapstone Duct Co.—Contained in this 12-page illustrated booklet are seven reasons why Oct-O-Duct is preferred. Some of these reasons are strength, uniformity, smoothness and flexible installation.

158 OPEN STEEL BRIDGE FLOORING

Kerrigan Iron Works, Inc.—A new catalog on Greulich 4-way Grid, 5-in. depth. It contains illustrations, full engineering data including properties and load tables. The pamphlet explains the ease of filling half depth with concrete where needed, economical, speedy field erection, and why 20% fewer field welds are needed. Grid fabricated in panels 7-ft 3-in. wide with lengths up to 42-ft.

159 OPTICAL TRANSIT

Geo-Optic Co., Inc.—An optical transit with erecting eyepiece, double center, T 50, represents a new low priced precision instrument enabling surveyors, engineers, etc., to cope with any possible problem of triangulation and to obtain results of the highest accuracy. A leaflet explaining this new type of theodolite is available.

160 PACKAGE-TYPE PLANT

Dorr-Oliver Inc.—A new 8-page bulletin, "The Dorr-Oliver CompleTreator", describes the design, operation and advantages of this new package-type plant for 150 persons. Designed to remove 90% of the BOD and suspended solids from 13,300-gal daily, the CompleTreator incorporates five treatment steps in a single tank, 11-ft 6-in. dia by 19-ft 9-in. high. Shipped completely assembled, it is particularly adaptable to motels, service stations, industrial plants, amusement parks and small housing developments.

161 PAVING HANDOOK

American Bitumuls & Asphalt Co.—The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials. These include road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, with condensed Asphalt Institute specifications. Also, there is data on Laykold compounded asphalts for flooring, tennis courts, and protective coatings.

162 PAVING PRODUCTS CATALOG

W. R. Meadows, Inc.—A catalog on Sealtight Paving Products . . . covering asphalt expansion joints, corkfill expansion joints, fibre expansion joints, center strip, dummy joints, concrete curing compounds, subgrade paper, base plate, rubber asphalt joint seal, sewer joint compounds and road marking paints is offered. The catalog not only contains all of the general information on each product, but also a Standard Specifications section that truly explains what specifications each product meets.

163 PAYSCRAPERS

International Harvester Co.—Payscraper operation and specifications are detailed in a new 12-page catalog (Form CR-638-H). Titled "Bid-Beating, Dirt-Heaping", the literature depicts operations of the models 55 and 75 Payscrapers on construction projects throughout the country.

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CATALOG DIGESTS

164 PENTAGONAL PRISM

Kern Instruments, Inc.—A 4-page color brochure on pentagonal prisms is now available. It goes into detailed description of what a pentagonal prism is, who uses it and for what purpose. It also shows, with the help of diagrams and detailed description, how it is used to check and set up right angles, to establish a point on line, to measure angles other than 90-deg and all other major applications.

165 PILE DRIVING

C. L. Guild Construction Co., Inc.—An eight-page brochure entitled "Pile Driving" includes a fairly comprehensive brief on piles and pile driving. This literature also describes in great detail the Cobi Cast-in-Place Concrete Pile, gives specifications and the method of installation. The brochure is amply illustrated with action photographs and various completed structures which rest on Cobi piles. Included also are detailed examples of recent load tests made on Cobi Cast-in-Place Concrete Piles.

166 PILE REPAIR

Masonry Resurfacing & Construction Co., Inc.—An eight-page illustrated pamphlet is offered describing the Dri-Por system of pile repair and encasement. The pamphlet describes the application of the Dri-Por system to the repair of the 5-mi James River Bridge system near Newport News, Va. Also included is a description of the Dri-Por K-box which allows repair of concrete piling in the dry, and high quality repair for wood and steel.

167 PILES

Raymond Concrete Pile Company—Standard and step-tapered piles are described in Catalog S-58 which also includes information on the scope of Raymond's activities covering every recognized type of pile foundation. Domestic operations include harbor and waterfront construction, and cement-mortar lining of pipelines in place. Raymond's services abroad also include all types of general construction.

168 PILES

The Union Metal Mfg. Co.—Catalog No. 81 on Monotube piles, in addition to general descriptive information, contains engineering data covering physical properties, specification suggestions and test loading; also, contractor data on concrete volumes and weights. It includes numerous photos showing a wide range of job applications throughout the country. Advantages listed: light weight, easy handling, economical field extendability, visual inspection after driving, highload carrying capacity with extra high economy per ton load supported.

169 PIPE COATINGS

Vulcan Materials Co.—Teckote, a protective coating for concrete pipe, is the subject of a new 6-page brochure. The manufacturer assures "life insurance" for concrete industrial and sewage lines with the use of Teckote-100. The brochure outlines tests which have been made of the new product. The text is further amplified with photographs, charts, tables and specifications.

170 PIPE PASSAGE PROCESS

American-Marietta Co.—A pamphlet containing many photos shows how the Tunneliner Process allows quick passage of elliptical pipe through pipe underground without disruption of surface traffic. New "2-way" Tunnelugger illustrates how one man can operate in either direction from a centrally located shaft to quickly deliver and position Inner Circles at either end while digging continues at the other. Discharge graphs and a diagram of hydraulic properties are also given on Inner Circles.

171 PNEUMATIC TIRE ROLLER

Bros. Inc.—An illustrated, 4-page brochure shows the full line of Bros pneumatic tire rollers. It shows these rollers in action of four different applications. A worm's-eye-view clearly illustrates how the wide face tires give full coverage with each pass. Diagrams also show the principle of rubber tire compaction with oscillating axles, and the special compaction advantages of exclusive wobble-wheel rolling.

172 POLE BUILDINGS

The Dow Chemical Co.—In addition to large, clear illustrations of the pole buildings being built quickly, the booklet also contains some good reasons for erecting pole buildings. They are low cost as they need no concrete foundations or expensive bracing. The poles are set firmly in the ground, rafters and siding are fastened solidly to the poles, giving exceptional wind resistance. Commercially treated poles assure a permanent type building, designed to withstand attack by termites and decay.

173 PORTABLE GASOLINE RAMMER

Barco Manufacturing Company—Offers an eight-page catalog describing the Barco portable gasoline rammer for soil compaction. This tool is the only successful mechanical means of obtaining specified soil compaction in restricted areas such as in trenches and near walls and bridge abutments. It is easy to operate, safe, and will compact 20 to 30 cubic yards of fill per hour where high degree compaction is specified. Barco also offers a bulletin "Cost Data for Soil Compaction in Restricted Areas with the Barco Rammer" of interest to all earthmoving contractors.

174 PORTABLE PILE HAMMER

Vulcan Iron Works, Inc.—Some of the features of the pile hammer discussed in a newly published pamphlet are: differential-acting; modern clean design; easiness of lubrication economically priced; and compact for close quarters and ease of handling.

175 PORTABLE RECOMP

Autonetics Div.—This brochure discusses the portable Recomp, which is a general purpose, all-transistor, digital computer. The catalog states that the instrument can automatically perform every long sequences of computation, making decisions and referring to memory as it works. It can process and act on a continuous flow of information from its input/output facilities. Complicated mathematical, engineering, or clerical computations which would take mathematicians months or years to solve are performed with great rapidity and extreme accuracy.

176 POWER HOUSES

Ingalls Iron Works Co.—A 36-page booklet illustrates numerous power houses and plants fabricated and erected by Ingalls, a major fabricator of structural steel and plate work for power houses.

177 PRECAST CONCRETE BRIDGE MEMBERS—AMDEK

American-Marietta Co.—An 8-page folder shows how Amdek prestressed, pretensioned concrete spans revolutionize bridge construction methods. It also illustrates skew beam tests, load distribution tests and tests to destruction being conducted in independent laboratories.

178 PRECISION INSTRUMENTS

C. L. Berger & Sons, Inc.—"Solar Ephemeris and Polaris Tables," 1958 Edition, 96 pages, contains complete instructions for determining azimuths from the sun and the altitude of Polaris, has been prepared by Herman J. Shea, formerly Associate Professor of Surveying, Massachusetts Institute of Technology. Directions for making astronomical observations and computing results by direct solar observation and time from same observation; meridian by solar attachment; meridian by Polaris at elongation; azimuth by Polaris at any hour angle; latitude by sun at noon, and latitude by Polaris are included. Price is $.50 per copy.

N. B. There is a charge for this book. Make checks payable to C. L. Berger & Sons, Inc.

179 PREMOULDED JOINTS

Expansion Joint Institute—This technical brochure is designed to provide engineers, architects and contractors with authoritative up-to-date information concerning the design, construction and maintenance of joints in concrete pavements. The manual contains a brief general discussion of joints and their uses in concrete pavements and slabs. Fundamental considerations concerning volume changes in concrete pavements and associated stresses are covered. The consequences of failure to provide adequate joints in concrete pavements are explained.

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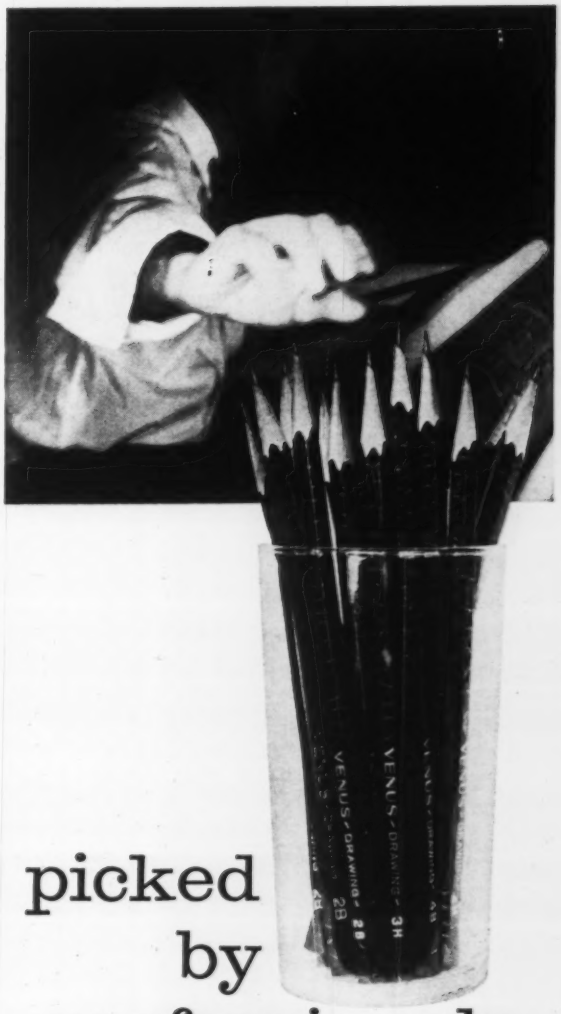

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180 PREPARATOR

Bros Inc.—This brochure describes how the in-place materials reducer breaks rocks up to 24-in. in diameter and produces over 400-cu yd of reduced rock per hour; how a Preparator can be used to pulverize old blacktop for re-use.

181 PRESTRESSED CONCRETE

The Master Builders Co.—Construction stories of 16 outstanding prestressed projects in this country and abroad illustrate the almost unlimited application of prestressed concrete. Photographs and job stories clearly cite the role played by Pozzolith in achieving the concrete qualities required for prestressed work. A prestressed lift slab, 120-ft prestressed bridge girders, and a 2 million gallon prestressed water tank are some of the outstanding projects covered. Both pretensioned and post-tensioned projects are featured in this new 20-page book.

182 PRESTRESSED CONCRETE DATA

Leap Concrete, Inc.—Free Prestressed Concrete data is available covering standard building sections including dimensions, physical properties, and table of loadings, for Double Tees, channels, and joists. This literature contains engineering data and technical information that should prove to be of great value to any firm contemplating the use or manufacture of prestressed concrete.

183 PRESTRESSED CONCRETE EQUIPMENT

Intercontinental Equipment Co., Inc.—The Prestressed Concrete Division has available a complete line of hydraulic pumps, jacks and accessories for the prestressed concrete industry. Pumps are either electric, gasoline, air or hand operated with pressures to 10,000-psi. Jacks are of the pull or push type, spring or hydraulic return. Special center hole jacks as well as threaded rams are also available. Information is given in a new catalog.

184 PRESTRESSED CONCRETE PILES

Raymond Concrete Pile Co.—Newly issued Catalog CP-3 describes and illustrates Raymond cylinder piles of prestressed concrete. Information is given on the merits of prestressed concrete piles for foundations of bridges, waterfront and offshore structures. Shown are many examples of installations and suggested designs.

185 PRESTRESSED CONCRETE TANKS

Preload Co.—"The Design of Preload Tanks," an 8-page booklet, discusses design requirements, walls, floors, roofs, etc. It features a detailed presentation for a typical 5,000,-000-gal tank or similar circular structure, complete with formulae and diagrams.

186 PRODUCT LINE RESTYLED

Granco Steel Products Co.—New equipment fabricates longer, stronger, more uniform sections of Corruform, Tufcor, Cofar, Structur-Acoustic and Roof Deck to provide the most advanced design in modern floor and roof systems. The new pattern line offers these engineered advantages: faster construction—longer sheets enable workmen to cover 50% more area with every sheet placed; wider spans—the sheets make possible continuous spans for less deflection, greater strength, economy and freedom in design; greater carrying capacity—new "hat-shaped" pattern increases sheet strength; lower framing costs—longer sheets, continuous over several supports, cut cost of framing in multi-span construction.

187 PROTEX DISPERSING AGENT

Protex Division, Autolene Lubricants Company—Contained in this 4-page booklet is valuable information concerning the Protex Dispersing Agent. PDA reduces the water requirement in all concrete mixes, including mixes with fly ash or other pozzolanic materials. This additional reduction in water requirement often makes otherwise unsound aggregate usable, giving satisfactory durable concrete, thus long and costly hauls from other good aggregate sources are avoided. Paragraphs on durability produced with PDA, workability increased with PDA and economy with PDA are also included.

188 PUMPING STATIONS

Zimmer & Francescon—The completely prefabricated Underground Pumping Station is described in an 8-page bulletin. Engineers and contractors on sub-divisions, industrial sites and other projects, where extensions to sewer systems require that the flow be raised to the level of existing mains, will be interested in the automatic operating features and simple installation requirements of the stations.

189 PUMPING UNITS

Sprague & Henwood, Inc.—A bulletin completely describes and illustrates various models of pumping units especially designed for core drilling, soil sampling and pressure grouting.

190 PUMPS

C. H. Wheeler Mfg. Co., Economy Pump Div.—a new 12-page catalog describes Axial and Mixed Flow Vertical and Horizontal Pumps for application in flood control, irrigation and drainage projects, large scale primary water supply, industrial and process work, and power plant condenser circulating systems. Capacities range from 5,000 to 200,000-gpm and over at heads from 5 to 75-ft. The booklet includes construction and design details, station arrangement suggestions, and illustrations of typical installations.

191 RADICON WORM REDUCERS

David Brown Corp.—According to this publication, the range of Radicon Worm Reducers comprises three sizes, 1⅛, 1⅝, and 2¼, and is designed to transmit fractional and small horse-powers from 0.03 to 3.50-hp. A choice of 11 standard ratios is offered from approximately 5:1 to 60:1 and addition, units with nonstandard ratios can be supplied to customers' requirements. Unique versatility is an outstanding feature as units can be operated in 40 different positions.

192 R/C DUCT FLOORS

Concrete Reinforcing Steel Institute—A 16-page booklet entitled "Electrical Outlets Wherever You Need Them," has just been published which gives complete details on R/C Duct Floors, a new development which provides 100% electrical flexibility for buildings at a new low cost. They consist of standard reinforced concrete joist floors with a network of electrical distribution ducts buried in the structural slab. With this type of construction, no special concrete "fill" is needed.

193 RECOMP COMPUTER

Autonetics Div.—According to this new brochure, Recomp automatically performs all of the computations and makes decisions based on the computations. In approximately 5 minutes Recomp will solve and print the answers to a bridge design problem that would take an engineer 40 man-hours to solve by standard methods. Each iteration of the design data (several may be required) by normal engineering methods needs an additional 40 man-hours. Recomp will make a complete iteration of all data in less than 5 minutes. Also available, is a booklet entitled "Recomp 11."

194 REINFORCED CONCRETE FLOOR SYSTEMS

Portland Cement Association—This 20-page booklet is intended to assist the architect or engineer in making his choice of a concrete floor system. The three types of floor systems discussed are: the one-way, two-way and the flat slab. There are also many combinations and modifications of these basic types to satisfy various functional and structural requirements.

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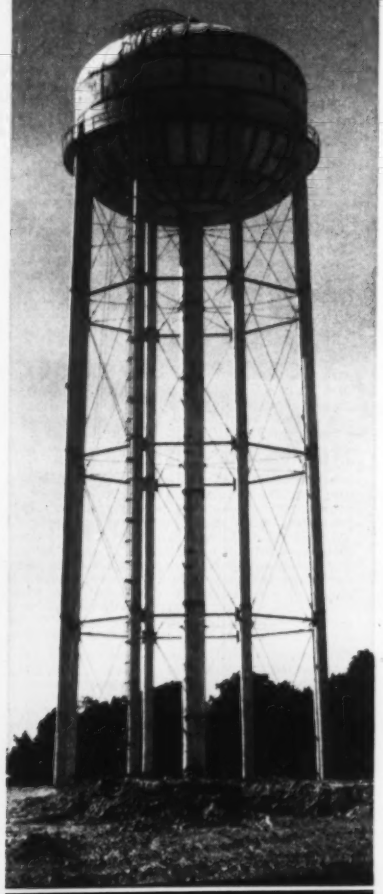

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195 REINFORCED CONCRETE PIPE

American-Marietta Co.—This pamphlet covers elliptical Lo-Hed Reinforced Concrete Pipe for culverts and sewers. Specifications are given for the complete range of sizes from the equivalents of round pipe 18-in. I. D. through 144-in. I. D. Illustrations show results of pressure tests and installations of Lo-Hed pipe being made on various types of jobs.

196 REPRODUCTION FILMS

E. I. Du Pont de Nemours & Co.—A colorful, descriptive 6-page folder on Cronaflex engineering reproduction film is now available. This folder clearly and concisely describes the properties and uses of the three Cronaflex films: direct positive; contact; and projection. Cronaflex is a new line of engineering reproduction films developed by Du Pont for the reproduction of drawings, plans and maps. All Cronaflex films are on Du Pont Cronar® polyester photographic film base.

197 REPRODUCTION PROCESS

Charles Bruning Company, Inc.—Has made available an 8-page booklet explaining the principles used in the Copyflex whiteprint process. In addition to explaining the process, the booklet also describes its use in the engineering field and illustrates the complete line of Copyflex machines.

198 ROAD BUILDING EQUIPMENT

International Harvester Co.—"The Power to Build America's Roads Profitably" is the title of a timely, 16-page booklet (CR-601-H). It describes editorially and pictorially the entire job of road building from "clearing to ribbon cutting". Diesel crawler tractors, wheel tractors, shovels, scraper, motor graders, cranes, rollers, pavers, and other equipment are all illustrated in this colorful literature.

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199 ROTO-MIXER

Bros Inc.—This brochure shows how the rugged Roto-Mixer stabilizes, pulverizes, blends and mixes all types of road materials. It illustrates heavy-duty design features which make this in-place mixer definitely superior to other similar machines.

200 SABRE BLADES

Dart Mfg. Co.—A booklet explaining a new device to vibrate concrete in extremely confined areas has been developed. These "Sabre" blades come in varying lengths and attach readily to Dart vibrators. Light in weight (17-lb), they are engineered of high grade spring steel for long life. Operating up to 10,000-rpm at high cycle or 14,000-rpm at 60 cycles, the slender blades easily offer full force, amplitude and frequency for close work in prestressed concrete or in any restricted area where normal vibrators cannot do the job.

201 SAWING MACHINE

Concut Sales, Inc.—A bulletin describes the improved Jointmaster Sawing Machine which is recognized as the most practical and efficient machine for large air base and highway sawing jobs. The machine is equipped with hydraulic drive for easy handling. The saw carriage is raised and lowered hydraulically and it has hydraulic torque converter cross feed. Up-cut action increases blade life. The Jointmaster is available in 12-in. and 24-in. models.

202 SCREENS & COMMINUTORS

Infilco Inc.—Bulletin 5150 describes the new Rotagrator® screen and comminutor which provides complete comminution of rags in addition to other sewage solids. The curved bar screen is fitted with cleaning rake and top fingers to remove any solids which are carried upward on the screen. The comminuting elements are submerged. The brochure includes graphs for sizing the comminutor for any flow rate from 150-gpm to 2500-gpm and suggested dimensions for the downstream Parshall flume.

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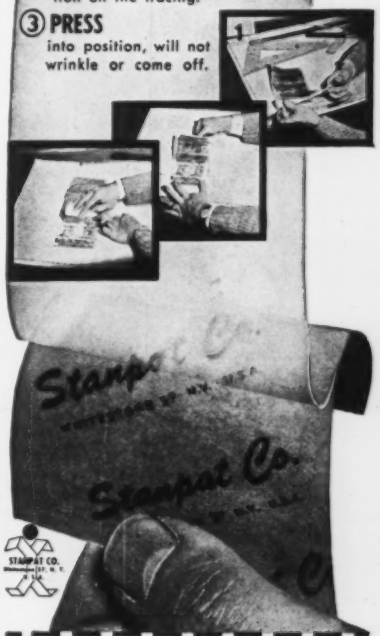

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203 SEEPAGE & POLLUTION CONTROL

Gulf Seal Corp.—Long-term dependability in the eliminating of the seepage and pollution on large industrial salt water storage pits, municipal drinking water reservoirs, canals and irrigation ditches is detailed in the fourth edition of the Gulf Seal's Corp. Engineering Brochure. The experiences of cities and a wide range of industries are comprehensively described, together with a complete description and application procedure of the flexible asphalt linings.

204 SELF-ALIGNING PAVING FORMS

Clark Industries—Included in this booklet are illustrations of the Clark forms with exclusive Wedge-Lok design, specifications, full description and operating instructions. Able to withstand the heaviest vertical and horizontal loading of paving equipment, three 10-ft sections contribute maximum strength as diagonal braces.

205 SELF-LUBRICATING BEARINGS

Lubrite Div., Merriman Bros., Inc.—Manual No. 56 is a 20-page book filled with complete information, technical data, and specifications about Self-Lubricating bushings, bearings, and washers for industrial equipment, machinery and Hydro-electric type applications.

206 SELF-LUBRICATING EXPANSION PLATES

Spadone-Alfa Corp.—Literature providing complete information covering Metaline oilless self-lubricating expansion plates and bridge bushings; also, Metaline bearings for underwater installations as found in dam and hydro-electric projects. Metaline products fully meet all federal and state requirements covering this type of material. This exclusive lubricant assures long, dependable service in heavy load, high temperature, submerged and corrosive applications.

207 SEWAGE REGULATORS

Brown & Brown, Inc.—manufacture a line of float controlled quadrant gates, in 37 sizes, to automatically control the diversion of sanitary flows from combined sewers to interceptors. Such automatic gates may be actuated either from head or tailwaters or dually from two sources. Bulletin 81A contains capacity and dimension charts.

208 SEWER & PIPE CLEANING EQUIPMENT

Miller Sewer Rod Co.—This free booklet tells how to clean clogged sewers and drains. It lists prices and information on all types of electric and hand pipe cleaning equipment for cleaning out clogged-up toilets, sinks, urinals, floor drains, and sewers from 3 to 12-in. up to 500-ft in length. Units listed are said to remove roots, grease, rags, sand, glass and obstructions. Helpful advice states how you can save costly plumbing bills.

209 SHAFT EQUIPMENT

Mayo Tunnel and Mine Equipment—A 4-page bulletin, No. 20-A, illustrates and describes in detail the Mayo Koepe Hoist system as well as headframes, sinking frames, mine cars, cages, kibbles and gilleys.

210 SIEVE SHAKERS

Soiltest, Inc.—A new Sieve Shaker bulletin is now available. Various types of field and laboratory sieve shakers, sieves and gradation equipment are illustrated and described.

211 SLAG CEMENTS

Universal Atlas Cement Co.—A 12-page brochure (8½x11) containing illustrations of projects (paving and structural) where this new cement has been used. Includes statements by contractors and engineers on their experience with concrete made with these cements. Plus description and advantages of the 2 types available; regular and air-entraining.

212 SLUDGE BED ENCLOSURES

Metropolitan Greenhouse—All-aluminum sludge bed glass enclosures, that are maintenance-free and superior to wood construction, are described in bulletin #656. Scientifically designed, these time-tested and proven alloys assure the ultimate in economy and durability for sludge bed enclosures. Plans, designs and specifications for all purposes are included in the bulletin. Electronic control of ventilation is another feature of this glass enclosure which eliminates many hours used in operating ventilation requirements.

213 SLUICE GATE

Rodney Hunt Machine Company—The first basic improvement in sluice gates in many years, the patented HY-Q flush bottom closure sluice gate, is described in Catalog 75. This booklet, with 12-pages of illustrations, clearly shows all details of construction, installation, and operation of the unique gate as used in water filtration plants, power plants, municipal and industrial plants, drydocks, and flood control. Diagrams and text explain the many practical advantages offered by the HY-Q gate for water flow control. Complete recommendations for selection of frames and other equipment for sluice gates, as well as detailed specifications, series numbers, and clearance dimensions are also given.

214 SLURRY SEAL

American Bitumuls & Asphalt Co.—"Bitumuls Slurry Seal" is a new operation which consists of mixing the aggregates with Bitumuls and water to a slurry consistency in a transit mixer, and spreading over the pavement by a specially constructed squeegee type spreader-box. The action of the squeegee forces the slurry into the fine cracks of a weathered but still sound surface of an old asphalt pavement, thereby reducing expensive maintenance patch construction to a minimum.

215 SOIL COMPACTION

Barco Mfg. Co.—The Vibra-Tamp, a versatile tool for maximum compaction of granular base materials and bituminous surfacing, is the subject of a 4-page bulletin. Whereas the Rammer covers the cohesive type soils where impact compaction is necessary, the Vibra-Tamp covers the non-cohesive type soils where surface finish is desirable. Specifications and on-the-job photos are included in the brochure.

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216 SOIL COMPACTION

Vibroflotation Foundation Co.—Available is a new booklet entitled "Soil Compaction by Vibroflotation" which describes the soil consolidation and engineering services of the Vibroflotation Foundation Co. The booklet illustrates the compaction of 8 to 10-ft cylinders of sandy soil to provide a firm foundation of sand for any type of structure. To make sure of complete coverage in a given area, these cylinders are overlapped according to a predetermined pattern under individual loadings or under entire building areas.

217 SOIL SAMPLING EQUIPMENT

Sprague & Henwood, Inc.—The recently completed 24-page soil sampling bulletin includes a wide selection of samplers to fill all soil sampling needs. In addition to the various samplers described in earlier bulletins, it includes the new S & H Vane Shear Tester, the Greer & McClelland Hydraulic Piston Sampler, the S & H Retractable Plug Sampler, and the Harpoon Type Sampler.

218 SOIL TESTING APPARATUS

TESTlab Corp.—A general catalog and desk book, 120-page, illustrated in two colors; a complete line of soils, bituminous and concrete physical testing apparatus for laboratory and field including all fringe materials. All listed in a unique new numbering system based on logical order of use.

219 SOLAR PRISM ATTACHMENT

Kern Instruments, Inc.—This pamphlet describes an accessory which fits over objective of Theodolites. It makes sun observation as easy, quick and precise as star observation. Prism arrangement creates overlapping images of the sun giving a pointing accuracy of better than 10-sec. Use of the attachment may eliminate night work. Manufactured by C. J. Van Leeuwen, Defft, Holland.

220 SPEED REDUCERS

The Earle Gear and Machinery Company—A sixteen-page illustrated catalog, describing speed reducers as applied to operating machinery, particularly bridge machinery, is available. Outlined are specifications service factors, horsepower ratings and dimensions of the particular units illustrated. Gasoline power units are also dealt with in a compact, easy-to-read form. Photographs are shown of actual installations with miniature blueprints included.

221 SPHERICAL BEARINGS

Industrial Tectonics—The subject of this booklet is stainless steel balls, which were used in the Indiana Toll Road ball joints. They were used instead of ordinary pins or small bearing areas because the columns will deflect considerably in the longitudinal direction of the structure due to temperature changes; and transversely due to the deflection of the structure acting as a horizontal truss.

222 STEEL CONCRETE CASTING FORMS

Food Machinery and Chemical Corp.—A 20-page bulletin describes the full line of Form-Crete casting forms. Contents include Double T, Bridge Beams, I Beams, Piling and other standard types plus a section showing a number of custom forms that were designed to customer specifications. Each form is illustrated and specifications are described in text and charts.

223 STEEL FOR HIGHWAYS

Bethlehem Steel Company—This 36-page illustrated booklet, "Steel for Highways," describes the broad range of Bethlehem steel products used in the construction of a modern highway. These include reinforcing bars, bar mats, dowel units, structural steel, wire rope, drill steel, pipe, guard rail and posts, fence and fence posts, sheet piling and bearing piles, culvert sheets, rock anchor bolts, etc.

224 STEEL FORMS

Blaw-Knox Co.—Included in this 48-page booklet are large, clear illustrations and full descriptions of the different types of forms such as deck, elliptical, collapsible, box shaped, and self-raising. Practical design suggestions for economical adaptation of steel forms are also contained in this brochure.

225 STEEL FORMS

The Heltzel Steel Form & Iron Co.—Some of the features illustrated in this brochure are: versatility—with a basic set of forms, a contractor is able to handle most curb and gutter jobs; the only flexible form to incorporate the overhead hanger which permits radius curb construction without breaks or scoring; maximum rigidity; and easy assembly.

226 STEEL JOISTS

American Bridge Division—This 40-page catalog is the only steel joist catalog containing complete design information for spans up to 120-ft. Such subjects as design calculations, bridging, properties and dimensions, end details and accessories, load tables, marking systems for ordering, and specifications are clearly and completely covered in this catalog.

227 STEEL RIGID FRAMES MANUAL

Martin P. Korn—Part one presents the fundamentals of analysis and design, including selection of type of frame, derivation of basic equations, and tables of design for single span frames of from 50 to 150 ft. Part two of the volume is a collection of actual designs of a number of structures: an auditorium, bridges, and others. Martin P. Korn is the author. (J. W. Edwards, Inc., Ann Arbor, Mich., 1953. 170 pp., $4.50.)

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228 STEEL SHEET PILING

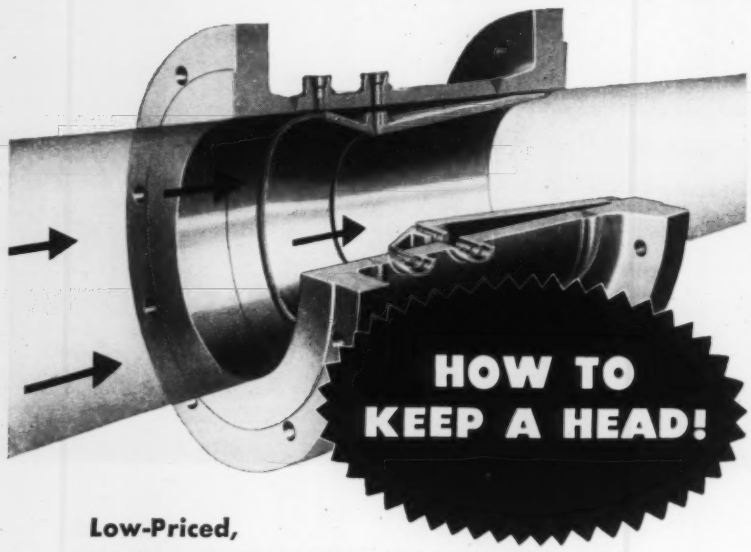
L. B. Foster Co.—A 20-page catalog lists the advantages of renting interlocking steel sheet piling and contains specifications for piling sections, as well as corners and connections. Drawings illustrate various types of sheet piling, and data is provided on dimensions, weight, and section modulus. Diagrams showing construction of several types of cofferdams are also included. On-the-job photos illustrate several typical installations.

229 STEEL & WIRE PRODUCTS FOR HIGHWAYS & STREETS

American Steel & Wire Div.—Under one cover, this booklet describes the many products applied to highways and streets construction. Products included are: Welded Wire Fabric, Transverse Road Joint Load Assemblies, Multisafty Cable Highway Guard, and Reinforced Concrete Pipe.

230 STRATAGRAPH

Edo Corp.—An illustrated brochure describes the new Model 400 Stratagraph, strata penetrating sonar which records, with sharp definition and complete accuracy, formations underlying rivers, lakes and other relatively shallow bodies of water. Sediment, intermediate layers, bed rock and faults are readily distinguished and pictorially shown on permanent chart. The brochure illustrates equipment and typical recordings.



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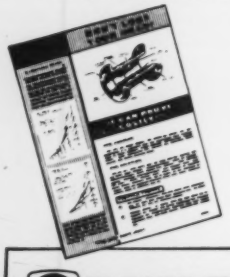

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231 STRUCTURAL ARC WELDING

The Lincoln Electric Company—A continuing series of studies—how arc welding is used in modern structures—is issued periodically. Case histories of welded bridges, buildings and miscellaneous structures; drawings, details and calculations for typical structures are included.

232 STRUCTURAL PADS

Lubrite Div., Merriman Bros, Inc.—Bulletin No. V-10 contains information and technical data on Vibridge structural pads for bridges. This brochure includes charts and graphs on Vibridge, physical properties and other important information.

233 SUPERHIGHWAY SIGNS

Reynolds Metals Company—According to this new 12-page booklet, Reynolds Aluminum extruded panels for Superhighway Signs provide new speed, convenience and ease of handling in the erection of highway signs. The built-in strength and rigidity of these panels produces signs that shrug off hurricane winds. Photographs of recent installations of signs using the aluminum extruded panels are included.

234 SURVEY DEPTH RECORDER

Edo Corp.—Literature describes and illustrates Model 255 and the Model 255A Survey depth recorders, with sample recordings. Precision sonar equipment for measuring depth of water (0-250 fathoms) with great accuracy, this compact equipment is readily installed on all types of survey vessels. Model 255A, with narrowed beamwidth, records with exceptional detail in relatively small areas.

235 SURVEYING EQUIPMENT

Eugene Dietzgen Company—Descriptions, illustrations and prices are contained in this 200-page catalog of surveying equipment. A few of the products included are: targets, range poles, leveling rods, theodolites and transits, prismatic compasses, tripods and surveyors' stake hatchets.

236 SURVEYING INSTRUMENTS

C. L. Berger & Sons, Inc.—A series of descriptive folders illustrating surveying instruments is now available. General characteristics are fully described with essential specifications for each instrument.

237 SURVEYING INSTRUMENTS

Charles Bruning Company, Inc.—Brunson engineering transits and levels, which incorporate patented dustproof ball-bearing construction, are described in a brochure now available. The brochure describes how use of the ball bearing principle prevents costly maintenance, eliminates looseness in bearings, and permits operation in temperatures ranging from 70-deg below zero to 160-deg above zero. It also illustrates various models of instruments.

238 SURVEYING INSTRUMENTS

Fennel Instrument Corp. of America—Literature is offered containing photographs, as well as detailed descriptions and prices, of the manufacturer's complete line of transits, levels and theodolites for all purposes. Also included is a description of the new planimeter which sets to zero automatically, just by touching a button.

239 SURVEYING INSTRUMENTS

W. & L. E. Gurley—The complete line of Gurley surveying and engineering instruments, including transits, levels alidades, are described in the newly-revised edition of Catalog 50. Transits described include the Hell Gate Precise Transit; Standard Precise Transit; Gurley Telescopic Solar Transit; Standard Precise Mining Transit; Optoplane Precise Transit for industrial use; Optical Plummet Transit. Included are cross-sectional drawings of many of the transits.

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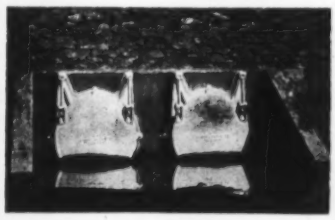


Fig. B-124-D

Two 60" Type M Gates on Relief Culverts near Woodward Pumping Station, Plymouth, Pa.

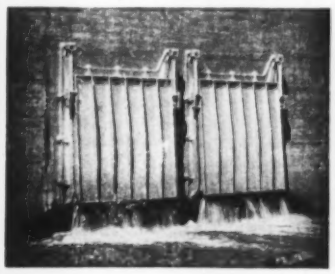


Fig. B-124-C

Two 72" x 72" Type M-M Gates on Toby Creek Outlet Works, Plymouth, Pa.

BROWN & BROWN, INC.

LIMA, OHIO, U. S. A.

CATALOG DIGESTS

240 SURVEYING INSTRUMENTS

Kern Instruments, Inc.—A 32-page brochure offers a brief description of the most important instruments manufactured by Kern & Co., Ltd., of Aarau, Switzerland. Fully illustrated, it acts as an index to the detailed literature available on each instrument. Included in the brochure are theodolites, levels, self-reducing tachometers, alidades, pentagonal prisms and many other instruments.

241 SURVEY MARKERS

Copperweld Steel Co.—This 4-page booklet, in color, lists specifications and describes both types of Copperweld Markers: the bronze head—to be driven flush into paved or even surfaces, and the tinned end—for quick visibility in uneven or heavily-foliaged areas. The pamphlet also includes an explanation of the Molten-Welding process by which the copper and steel in all Copperweld Products are inseparably united.

242 SWIMMING POOL EQUIPMENT

National Pool Equipment Co.—offers to all engineers and architects two four-color catalogs describing in detail residential and commercial swimming pool equipment and supplies. In addition to this, descriptive literature on prestressed concrete packages and filter equipment is offered.

243 "T-1" ALLOY STEEL

United States Steel Corp.—The most comprehensive collection of facts and data about USS "T-1" constructional alloy steel. Complete data on available sizes, forms, conditions, fabrication, welding and application of this 3-times stronger than structural steel product. Complete properties and characteristics. 64 pages.

244 TAPPING FLUID

Termite Drills, Inc.—Form RT-57 illustrates and describes Rapid Tap, an amazing compound that makes tapping easier, releases stuck taps, stops tap breakage, increases thread accuracy and improves surface finish. It is highly effective in tapping, reaming, drilling, boring, threading, lathe cut-off and profile milling and can be used on all metals or alloys. Rapid Tap is non-inflammable, non-explosive and does not contain carbon tetrachloride.

245 TECHNICAL DATA CATALOG

Lefax Publishers—A newly revised catalog for 1958 of Lefax Pocket Size Technical Data Books has been announced. Selling at $1.25 each, these handy books cover every field of engineering and are of constant use to engineers, technical men, surveyors, shopmen, teachers and students. They contain about 140 loose leaf pages of concise, comprehensive, and authoritative material. A partial list includes highway engineering, surveying tables, surveying theory and practice and conversion tables. The catalog will be sent free of charge.

246 TECHNICAL & FADEOUT PAPERS

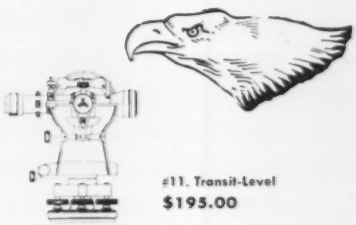
Clearprint Paper Co.—Specifications, prices and samples of Clearprint technical and fadeout papers are contained in this new brochure. Some of the points enumerated are: easiness on the eyes, erasing without ghosting, and faster sharper reproductions can be made.

247 TECHNICAL-TEST-KIT

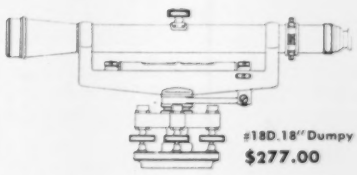
Venus Pen & Pencil Corp.—offers free a Technical-Test-Kit with two Venus Drawing pencils. Venus' patented Colloidal Process produces finer lead particles to insure a more even deposit on drawings. Homogenized lead assures silk-smooth performance. Pressure-Proofed for extra strength. These pencils are preferred by professionals for: sharper, clearer, perfectly consistent lines. Unvarying accuracy in all 17-deg of hardness allows a greater uniformity of tone.

248 TELE-PLUMB

Warren-Knight Co.—In addition to a cutaway drawing of the Tele-Plumb, instructions on how to use the instrument, and prices, this pamphlet contains a list of special features such as: elimination of the Plumb Bob; nothing to attach or detach between set ups; and can be used on Transits or Transit-Levels. Also includes a description of the Plano-Shift Model 90-S.



#11. Transit-Level
$195.00



#18D. 18" Dumpy
$277.00

A Lifetime of Precision is Built into Every

#6B. 6" Limb
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Eagle INSTRUMENT

Their manufacture by lower priced skilled foreign workmanship allows the engineer to equip a complete field party at lower cost than the price of other corresponding instruments alone.

A complete parts replacement and factory repair service is available in Dallas for all of these instruments, which are guaranteed a year against defective materials and workmanship.

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Maintenance Costs Cut By 75%

Over a 50 year service life, a prestressed concrete tank will show a 75% saving in total maintenance costs over a steel tank of the same capacity. In today's economy, such a long range saving has tremendous appeal to municipalities and water companies throughout the world. When your tank requirements are in the planning stage, these calculated maintenance costs should be considered. Average yearly maintenance on a 3,000,000 gallon steel tank is estimated at $2500 per year at current prices. For a prestressed concrete tank, maintenance is negligible; however, occasional painting for color effect may be desired.

When the charges for servicing the initial cost plus relative maintenance allowances are plotted, the prestressed

concrete tank will often show a lower out of pocket cost to the owner in less than 5 years. When these costs and their increases are extended for an expected service life of 50 years, the savings to the owner with prestressed concrete are enormous.

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And, 75% of the contract price is spent right in your local community . . . construction is done with materials and labor available locally.

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2211 East 19th Street, Kansas City, Mo.

HERRICK IRON WORKS
28400 Clawiter Road, Hayward, California

THE PRELOAD COMPANY, INC.
Jefferson Tower Bldg., 351 Jefferson, Dallas, Tex.

CATALOG DIGESTS

249 TENNIS COURTS

American Bitumuls & Asphalt Co.—"Laykold Tennis Courts" is the title of a 12-page, four-color booklet containing detailed specifications and color photographs of typical installations. There are sections on cost, maintenance, resurfacing and player acceptance. These bituminous courts offer resilient, grit-free, all-weather type surfaces.

250 TESTBORER DRILL

Penndrill Manufacturing Division—The Testborer Bulletin completely describes and illustrates the Model "B" Testborer Drill which is a new development of Penndrill Manufacturing Division. The Drill incorporates into one compact portable drilling unit the features of an Auger Drill, Core Drill and can automatically drive pipe and drive soil samplers with an exact 30 inch free fall hammer blow. Also illustrated is the Testborer Jr. Drill, which is a new lightweight Auger-Core Drill.

251 TESTBORING SUPPLIES AND EQUIPMENT

Penndrill Manufacturing Division—A recently published Testboring Supplies And Equipment Catalogue illustrates and describes various Testboring methods and equipment. It was written to give the layman a clearer understanding of sub-surface investigation.

252 THE EFFECTS OF CALCIUM CHLORIDE

Solvay Process Division—This is a 40-page booklet which is of interest to architects, engineers and others concerned with specifications, design or production of cement concrete. The booklet contains a variety of tables, graphs and charts dealing with the setting time, early strength, curing, density, surface wear, shrinkage and ultimate strength. Also shown are effects of varying temperatures and cold weather, and the results with special cements including air-entraining, high early strength and low heat cements.

253 THEODOLITE

Geo-Optic Company, Inc.—A leaflet describes the optical universal theodolite Askania Tu with a direct reading of one second and estimation 1/10 second. The Askania Tu Transit enables surveyors to cope with any possible problem of triangulation and to obtain result of the highest accuracy. All readings are done from one position—an important time factor. Other advantages and data are included.

PLEASE BE PATIENT
YOUR REQUESTS TAKE TIME!

254 THERMOCOPY BALL PEN.cil

Venus Pen & Pencil Corp.—offers free a sample Venus Thermocopy Ball Pen.cil . . . the newest in duplicating writing instruments. Specially designed to give clear, legible reproductions in duplicating processes. Newly formulated super-opaque ink allows markings on originals or masters which will reproduce sharply and clearly on most all types of duplicating machines. Available in black, red, green or blue non-smear ink. May be used for Thermofax, Bruning, Diazo, Verifax and Offset (Multilith) processes.

255 THE SMALL COMPUTER

Royal McBee Corp.—Entitled "The Small Computer & Decentralized Computing Facilities," S-532, this 5-page article reprinted from "Electronics & Communications," contains a discussion of ways engineers can use a desk-size computer. It also includes comparisons of the small computer with the large computer.

256 TIDE GATES

Brown & Brown, Inc.—Literature fully describes a complete line of metal tidal gates in 22 circular sizes and 47 rectangular sizes. Also described are timber gates to meet any requirements and a line of cushioned flap gates for use on pump discharge lines. Dimensional and loss of head data are given.

257 TORQUE CRANE

Pacific Coast Engineering Co.—According to a new booklet, the Dual Torque affords high speed operation with light load and speed with heavy load—with an almost infinite number of speed steps in-between. This flexible operation is performed by one hook, one trolley hoist and one set of electric controls utilizing a magnetic amplifier in conjunction with a weakening of the shunt field in the hoist motor.

258 TORQUE MANUAL

P. A. Sturtevant Co.—A 27 page manual (second edition copy) has been compiled at their laboratory to aid those persons responsible for torque control, specifications and applications. Detailed technical data on torque principles, designs, signaling devices, together with drawings and formulas is given.

259 TRACTOR SHOVELS

Allis-Chalmers Mfg. Co.—Operating, performance and maintenance advantages provided by HD-16G and HD-21G tractor shovels are told through pictures and story in a new 8-page, 2-color catalog now available. Also included are engineering, design and construction features of these two models, which, with aforementioned advantages, provide the big capacity, cost-cutting and versatility users want and demand in their equipment.

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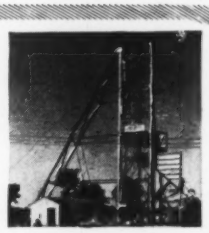
SINKING FRAMES
and
HEAD FRAMES



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MAYO
TUNNEL AND MINE EQUIPMENT
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CATALOG DIGESTS

260 TRAILER BATCHER

L. O. Funderburk, Jr. Mfg. Co.—Besides distinct photographs of the trailer batcher in action, this brochure offers a list of facts concerning the new equipment. Some of the points enumerated are: the batcher may be moved at highway speeds without permit behind truck, pickup or car, and set up in minutes to work; it may be operated by one front-end loader-operator, one laborer; and there are no belts, gears, sprockets, chains or engines.

261 TRANSITE PRESSURE PIPE

Johns-Manville Corp.—"Transite Pressure Pipe and the Ring-Tite Coupling" is an illustrated, 8-page booklet which describes methods in producing this asbestos-cement pipe for water systems and also describes savings in installation time and outlines characteristic advantages once the pipe is in the ground. Step by step, it gives recommended procedures for installing the pipe and assembling the Ring-Tite Coupling. A table of sizes and classes is included.

262 TRANSITE SEWER PIPE

Johns-Manville Corp.—"Transite Sewer Pipe with Ring-Tite Coupling" is an 8-page booklet which illustrates and explains economies which this asbestos-cement pipe can effect in the design, installation, operation and maintenance of a sewer system. It shows how the Ring-Tite Coupling makes tight joints more quickly. It covers related items such as the Transite Sewer Pipe Fitting for connecting to Transite building sewer lines. The booklet concludes with a table of sizes, weights and crushing strengths.

263 TRI-ACETATE SHEETS

Stanpat Company—circular describing their printed adhesive-backed acetate sheets for speeding up drafting is available. These sheets are attached to original drawings and save draftsmen from redrawing standard details and repetitive notes. Resulting prints are clear and sharp and save tremendous amount of time.

DID YOU MAKE YOUR CHECKS PAYABLE TO THE PROPER COMPANIES? ARE THE AMOUNTS CORRECT?

264 TRUCK CRANES

Harnischfeger—Four truck cranes are illustrated in this booklet—255-ATC—20-ton capacity, 355-CTC—25-ton capacity, 455-BTC—30-ton capacity and 555-ATC—35-ton capacity. Time proved features of the cranes are adjustable hook rollers, smooth, low-pressure hydraulic control, and triple-safe boom hoist. On the job pictures are also contained in this 28-page brochure.

265 TUNNEL & MINE EQUIPMENT

Mayo Tunnel & Mine Equip. Co.—A newly revised 8-page Bulletin No. 22 shows installation shots of Mayo steel forms, head frames, mine cars, couplers, kibbles and gilleys, grouters and many other pieces of equipment for tunnel haulage and mine shaft construction.

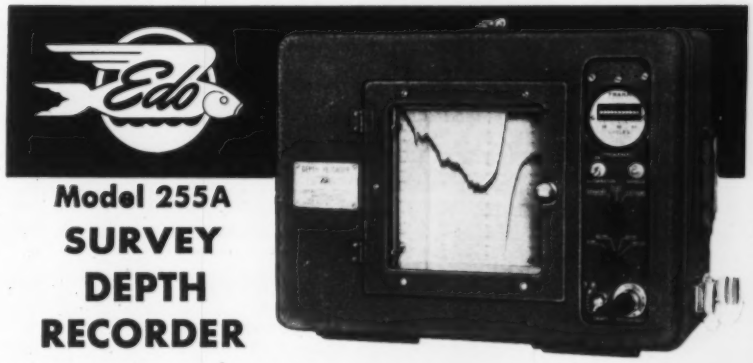
266 TUNNELS

Spencer, White & Prentis, Inc.—"Famous Subways and Tunnels of the World," by Edward and Muriel White recounts the fascinating history of subways and tunnels from earliest times. The price is $2.75.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

267 TURBOCHARGED DIESEL POWERED TRACTOR

Allis-Chalmers Mfg. Co.—Major advances in design of the HD-21 diesel powered tractor are described in the two-color, 16-page catalog (MS-1243) now available. Photographs and other illustrations point to these features and help tell the engineering and construction story of the tractor. Matched equipment and a line of accessories are also pictured. Tractor specifications are included.



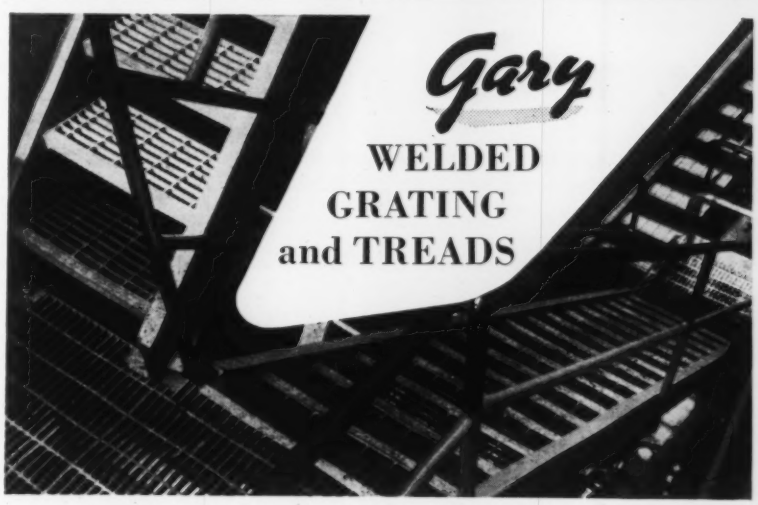
Edo Model 255A Survey Depth Recorder, designed expressly for underwater dredging and cable laying operations, employs an extremely narrow beam pattern (6° at −10 db) to obtain precise, detailed contour information. High operating frequency, 110 kc, minimizes penetration of silt or mud with the result that the recorder accurately pictures the soft bottom that is of concern in dredging.

Also available is Edo's Model 255B Survey Depth Recorder, with standard beamwidth (20° at −10 db), the ideal equipment for deep depth, penetration and general survey. With dual beam transducer, Model 255B can increase beamwidth to 40° at −10 db.

Edo Models 255A and 255B are both manually adjustable for transducer draft or sound velocity and record in eight overlapping ranges, 0 to 250 fathoms.

For illustrated brochures, write Dept. V-4

Edo CORPORATION, College Point, L. I., N. Y.



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- **TAILOR MADE**—for most economical installation.
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CATALOG DIGESTS

268 TWO COMPACTING UNITS IN ONE

Galion Iron Works & Mfg. Co.—Bulletin No. 423 presents Galion's combination 3-Wheel Roller with Jackson Electric Vibratory Compactor. It shows how you get the compressing action of massive roller weight plus the consolidating action of vibration. It is claimed this unit is so effective that density specifications such as Proctor, Modified Proctor, and AASHO-T99-49 are often attained in one pass per lift.

269 TYLOX RUBBER GASKETS

Hamilton Kent Mfg. Co.—A new 16-page booklet entitled "Specify Tylox Rubber Gaskets" describes and illustrates with distinct photographs a few of the many installations where the flexible, leak-proof and root-proof gaskets have done their job even under the most adverse pipe laying conditions.

270 TYPE S CONTROLLER

Simplex Valve & Meter Co.—A comprehensive and well documented 12-page bulletin, No. 900, of interest to engineers, operating and maintenance personnel of municipalities, public works plants, processing industry plants, etc., dealing with water usage and its conservation has been prepared. Valuable data on details of design, capacities, dimensions, and typical installations are included. The Type S Controller is a device that can be used to regulate flows of liquids in a line and specifically in filter plants and to maintain a uniform rate of filtration through each filter unit.

271 UNCONFINED COMPRESSION TESTING

Soiltest, Inc.—A 54-page manual on Unconfined Compression Testing of cohesive soils. The manual covers in detail the types of unconfined compression test apparatus, preparation of samples, detail test procedures, interpretation of test results and the use of these results in design and research activity.

272 UNDERPINNING

Spencer, White & Prentis, Inc.—"Underpinning," a book by Edmund Astley Prentis and Lazarus White is recognized as the authoritative source for information in the field by engineers, architects and contractors all over the world. The price is $10.

N. B. There is a charge for this book. Make checks payable to Spencer, White & Prentis, Inc.

273 UTILITY AUGER DRILLS

Salem Tool Co.—A 2-page, 2-color brochure explains the regular duty and heavy duty Trench Type Utility Auger Drill for boring under streets, highways, turnpikes, and railroads for laying of pipe lines, gas, oil, water, etc. The drill bores dry holes from 2- to 36-in. diameter. They can be equipped with pipe pushers. Special drills are designed for many jobs.

274 VALVE AND REMOTE CONTROL SYSTEM

S. Morgan Smith Co.—Catalog describes a standardized "package" of SMS-Rotovalve or R-S Butterfly Valve and controls. Designed to satisfy, either singly or in combination, basic applications where you need precise positioning and indication, or remote control, it is suited to water and sewage works applications or industrial processing. The system consists of valve, packaged hydraulic positioner or electric-motor-operator placed next to valve, and master remote unit which controls operation from locations a few or many miles away.

275 VERSATILE CAST IRON PIPE

Cast Iron Pipe Research Assoc.—An illustrated booklet provides pictorial proof of the ruggedness and durability of cast iron pipe in water supply and distribution systems; feeder and distribution mains for the gas industry and sewer mains; and industrial service. Also available is a convenient slide rule for determining friction losses in pressure pipe.

276 VERTICAL TURBINE PUMPS

Layne & Bowler, Inc.—A 72-page hard-back book entitled "The Answers to your Questions about Layne Vertical Turbine Pumps" is ideal for quick reference, complete with cut-away diagrams, illustrations, pictures and charts, and written by one of the foremost authorities on vertical turbine pumps.

277 VERTICAL WATER WELL

Ranney Method Water Supplies, Inc.—The newest development in the vertical waterwell field is the subject of a new brochure. Called the Vertube, it is a natural gravel vertical water well, designed exclusively for low volume users, at low cost. A diagram of the well completes the brochure.

278 VIBRATORY EQUIPMENT CATALOG

Jackson Vibrators, Inc.—Multiple Compactors for maximum consolidation of sub-base courses in macadam construction, fills, etc. Manually guided Compactors for paving blacktop walks, drives, pavement patching, widening, consolidation of granular soils in trenches, close to abutments, concrete floor sub-bases, etc.; Concrete Vibratory Screeds; Vibratory Tubes for Internal and Surface Vibration in Concrete Paving; General Construction Vibrators; Portable Power Plants.

279 VIBRO-TAMPER

The International Vibration Co.—This new pamphlet describes the Vibro-Tamper as having capacities ranging from 250 to 450-cu yd per hr, depending on job conditions. The high-powered vibration and tamping forces are said to penetrate to a depth of 3-ft, resulting in earth compaction, making subbases and earth-support less subject to traffic vibrations. Specifications and photographs are included.

280 VISUAL CONTROL SYSTEMS

Graphic Systems—A 24-page illustrated booklet, "Graphic Visual Control," explains the operation of the Boardmaster Graphic Visual Control and pictures typical applications. It shows how the system is used for production, scheduling, inventory, maintenance, etc. You type or write on cards and post on board to picture operations step-by-step or period-by-period. Planning sheet and sample cards are included.

RETURN THE COUPON TODAY FOR IMMEDIATE RESULTS!

281 WATERSHED PROGRAM

Caterpillar Tractor Co.—Calling to the attention of contractors the potential for prosperity and growth is a new two-color booklet, "Your Share in the Small Watershed Program." The amply illustrated brochure points out the Federal Watershed Protection and Flood Prevention Act (Public Law 566) is gaining momentum with watershed projects approved for construction in more than 30 states, with total earth-moving yardage of over 44 million cubic yards. It is also noted that approximately 700 watershed projects are in preliminary planning phases. Watershed jobs in Texas, Nebraska, Iowa, Delaware, Kentucky and Oklahoma are pictured and described in the booklet.

282 WATERSTOP MANUAL

The Durajoint Technical Information Center—Contains complete information on Durajoint and Duraseal Polyvinylchloride-PVE Waterstops, for expansion and construction joints. "Durajoint" was specifically compounded and designed for use between adjacent sections of concrete structures. "Durajoint" may be spliced on the job by merely applying heat and holding the ends together until bonded. Requires no welding or vulcanizing equipment.

283 WATERSTOP TECH-TIPS AVAILABLE

Durajoint Technical Information Center—has ready for distribution, a complete series of Durajoint "Tech-Tips." This series of technical data sheets tells where, why and how to use Durajoint Waterstops. Graphically illustrates how to form-work, install, set-up and how to quickly and easily splice this Waterstop on the job. Covers many applications.

CATALOG DIGESTS

284 WATER SUPPLIES

Ranney Method Water Supplies, Inc.—"Supplying Water for Municipal and Industrial Use," a 24-page catalog, explains how the Ranney Method can provide any type of water program for these uses. Horizontal collectors, infiltration galleries, vertubes, and intakes are fully described. Photographs and schematics depict each operation.

285 WELD-CRETE TESTS

Larsen Products—A few of the subjects discussed in this 4-page reports on Weld-Crete made by Pittsburgh Testing Laboratory are: the prescribed procedure for tests; the concrete experimental mix used; the mix data; and an analysis of the tests results.

286 WELDED GRATING

Globe Co.—The Gold Nugget Grating is a heavy duty grating of lighter weight made by a new type of projection weld that results in a strong, versatile open steel floor grating to complement Globe's Grip-Strut grating. A 28-page illustrated catalog shows the details of this grating, which is suited for powerhouses, oil refineries, drain grates, loading docks, fire escapes, plating or filtration rooms, sidewalk grating and all types of heavy duty platforms.

287 WELDED & RIVETED GRATINGS

Klemp Metal Grating Corp.—A newly revised 4-page brochure details specifications, safe load tables, diagrams, descriptions, etc., of Klemp welded and riveted gratings. Riv-Dexteel, Bridge Decking, Drain Grates and varieties of stair treads. Technical drawings indicate installation and applications of these products.

288 WELLPOINT DEWATERING

Griffin Wellpoint Corporation—"The Wellpoint System in Principle and Practice" is a handbook of the fundamentals of wellpoint dewatering and is applicable to any wellpoint system regardless of manufacture. This handbook contains information on how a wellpoint system functions, and methods of planning, layout, installation and removal of the system. The manual is pocket size, 109 pp in length and contains 62 diagrams and illustrations. The price is $1.50.

N. B. There is a charge for this book. Make checks payable to Griffin Wellpoint Corporation.

289 WELLPOINT DEWATERING SYSTEM

Griffin Wellpoint Corporation—A catalog describes the many items of Griffin wellpoint equipment together with pump capacity charts. It contains a series of actual job photographs showing this equipment on various types of construction projects.

290 WELLPOINT DEWATERING SYSTEM

John W. Stang Corporation—A 100-page catalog describes the component parts of the Stang wellpoint unwatering system; its planning, engineering and various methods of installation. Numerous recent projects have been added to demonstrate either a new application or some novel technical feature in the engineering and installation of the wellpoint equipment. Specific installations on dams, powerhouses, pipelines, tunnels, are illustrated from photographs made in the field. Heavy construction of all types in all varieties of soil conditions where ground water is encountered is described fully.

291 WELLPOINT SYSTEM

Moretrench Corporation—an informative 76-page catalog, fully illustrated, describes the Moretrench wellpoint system and its use in dewatering various types of construction projects. It includes useful technical data on the system.

292 WELL WATER SYSTEMS

Layne & Bowler, Inc.—Well water systems, pumps, drilling, as well as allied services and equipment are the subject of a 4-page bulletin. The folder describes the products manufactured by Layne, which has specialized in the development of ground water for over 75 years.

293 WHITEPRINT MACHINE

Ozalid Division, General Aniline & Film Corp.—Information on the Printmaster 1000, a high speed and high volume whiteprint machine for the reproduction of drawings and a wide variety of other forms is available. The new machine, which accommodates materials up to 54-in. in width by any length, prints and develops at speeds up to 100-ft per min. High print quality is assured by a 9,000 watt hermetically sealed high pressure mercury vapor lamp and automatic ammonia feed for full development synchronized for all printing speeds.

294 WIRE HANDBOOK

Pittsburgh Steel Co.—A new 120-page Manufacturers Wire Handbook featuring almost 100 types of steel wire is now available. Sections in the handbook are devoted to cover spring wire, ACSR core wire, strand wire, rope wire, high carbon specialties, shaped wire, wire for cold heading and cold forging, welding quality wire, wire for industry, mill practices and Johnson Steel's 21 different specialty wires. The latter range from aircraft cord wire to tire bead wire. Each of the types of wire is individually described in the handbook and data such as size range, weights, tensile strength and chemical composition is provided. Sixteen pages are devoted to tables and a hardness conversion chart. A handy glossary describes technical and semi-technical terms used in the well-illustrated handbook.

295 WIRE ROPE RECOMMENDATIONS

John A. Roebling's Sons Corp.—Gives proven engineering recommendations, practical usages and catalog information in a single, easy-to-read volume. Contains sixteen thumb-indexed sections with data on Roebling "Royal Blue" and "Blue Center" wire ropes, and cords and strands, as well as application details for major equipment and industries. Ask for "Wire Rope Recommendations and Catalog."

296 WIRE ROPE SLINGS

John A. Roebling's Sons Corp.—47 pages covering all details of the major types of slings made by Roebling: All-Purpose, Roegal, Flat-weave Slings & Fittings. Gives all sizes, capacities, ordering information and general information. Complete descriptions of fittings, thimbles, sockets, etc. Also general sling information. Ask for A-938.

297 WOOD & STEEL TYPE DOORS

The Kinnear Mfg. Co.—The catalog and data book discusses fully and illustrates the advantages, the economy, the construction features and the general specifications of the various types of wood and steel upward-acting type doors. Known as Bulletin 96 it gives information on installation, clearance requirements, methods of operation and controls, as well as adaptability of the doors for many types of uses.

298 XEROX COPYING EQUIPMENT

The Haloid Co.—A 4-page, 2-color brochure describing the use of XeroX[R] Model 1218 copying equipment by the U. S. Army Signal Corps. It illustrates and explains how the Signal Corps is saving $500,000 a year by xerography and offset duplicating in the reproduction of engineering drawings and specifications to accompany invitations for bids.

299 VALVES AND FITTINGS

Stockham Valves & Fittings—Detailed construction features of Stockham's complete line of A.W.W.A. valves are given in a new 6-page folder. Photographs, diagrams and tables are used to describe these double disc gate valves.

There are 299 Digest items on pages numbered 134 to 163. Read all items for the literature of interest to you.

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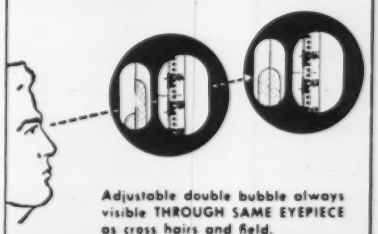

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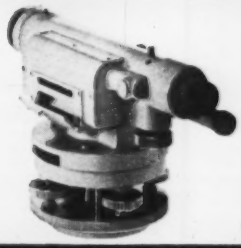

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February

1544. Cement and Clay Grouting of Foundations: Present Status of Pressure Grouting Foundations, by A. Warern Simonds. (SM) Present-day uses of pressure groutings are described. Recent developments and improvements of drilling and grouting equipment, and also of grouting materials are mentioned. Examples of successful grouting are cited where core drilling has produced rock cores from foundations with cracks and seams well filled and bonded with cement grout.

1545. Cement and Clay Grouting of Foundations: Grouting with Clay-Cement Grouts, by Stanley J. Johnson. (SM) The uses of suspension grouts consisting of soil or soils and cement are reviewed, with a discussion of the design of grout mixtures.

1546. Cement and Clay Grouting of Foundations: The Use of Clay in Pressure Grouting, by Glebe A. Kravetz. (SM) This paper reviews properties, preparations, and testing of clay, clay-chemical, clay-cement, and clay-sand-cement grouts. Field techniques are cited.

1547. Cement and Clay Grouting of Foundations: The Use of Admixtures in Cement Grouts, by Alexander Klein and Milos Polivka. (SM) Aspects of the use of admixtures are presented with respect to grout mixtures. Types of admixtures, test equipment, and methods of testing are examined. Typical relationships among grout properties are illustrated.

1548. Cement and Clay Grouting of Foundations: Suggested Specifications for Pressure Grouting, by Judson P. Elston. (SM) In the field of foundation treatment, it is improbable that all problems arising during construction can be anticipated by the designer or specification writer. A workable and equitable specification can be resolved from previous experience and practices, geological data, design criteria, and the capabilities of the engineer confronted with a new foundation site.

1549. Cement and Clay Grouting of Foundations: Pressure Grouting with Packers, by Fred H. Lippold. (SM) The use of packers for controlling the injection of grout into a rock foundation is presented. A description of common types of packers currently being used is given, with comments on their adaptability to rock foundations. Advantages and disadvantages of the procedure are cited.

1550. Cement and Clay Grouting of Foundations: French Grouting Practice, by Armand Mayer. (SM) European experience has indicated that clay and clay cement grouts can be utilized to successfully control seepage through alluvial materials. Descriptions of foundation conditions, grouting programs and nature of the grout mix are given for four projects: Genissiat cofferdam, Fessenheim open pit, Ait Ouarda cofferdam, and Serre-Poncon dam.

1551. Cement and Clay Grouting of Foundations: Practice of the Corps of Engineers, by Edward B. Burwell. (SM) The cement grouting practice of the Corps of Engineers during the last decade has adhered closely to a well-established pattern of design and procedure. This paper outlines this practice, and the current grouting specifications requirements of the Corps.

1552. Cement and Clay Grouting of Foundations: Experience of TVA with Clay-Cement and Related Grouts, by George K. Leonard and Leland F. Grant. (SM) Most of the dams built by the TVA have required large amounts of grouting for foundation preparation. Clay-cement grout has been used where feasible, and it has been possible to obtain safe and watertight foundations at a much lower cost than by using usual neat-cement grout.

1553. Trajectory Bucket-Type Energy Dissipators, by E. A. Elevatorski. (PO) Factors in the design of trajectory bucket-type energy dissipators are given in this paper, with data from model and prototype tests. For all contemplated structures recourse to laboratory model studies should be made to refine or verify the merits of each design.

1554. Underground Power Houses in Italy and Other Countries, by Claudio Marcello. (PO) This paper presents the characteristics of a number of underground power houses mainly constructed in Italy on the writer's design or with his cooperation. The criteria aiding in the choice of the solutions adopted are given special attention.

1555. The Sudagai Underground Power Plant, Japan, by Tatsuo Mizukoshi. (PO) A description of the Sudagai project is presented, with attention given to costs and methods of excavation and concreting, model studies, and seismic forces.

1556. Montgomery Dam—Rock Fill with Asphaltic Concrete Deck, by F. W. Scheidenhelm, John B. Snetlage, and Arthur N. Vanderlip. (PO) This paper describes various aspects of design and construction of a rock-fill dam with an asphaltic concrete deck. The advantages and economy of this type of dam construction are cited.

1557. Discussion of Proceedings Paper 1078, 1115, 1178, 1224, 1274, 1336. (SA) No closure notice to 1078. Donald J. O'Connor and William E. Dobbins closure to 1115. John R. Snell closure to 1178. Marvin L. Granstrom closure to 1224. Tsung-Lien Chou on 1274. Leon E. Chase on 1336.

1558. Discussion of Proceedings Paper 882, 1038, 1162, 1166, 1167, 1197, 1202, 1260, 1262, 1266, 1331, 1332, 1345, 1395. (HY) No closure notice to 882. Hunter Rouse closure to 1038. A. M. Moore closure to 1162. David K. Todd closure to 1166. M. B. McPherson, H. S. Strausser, and J. C. Williams, Jr., closure to 1167. Vito A. Vanoni and Norman H. Brooks; E. Roy Tinney; M. L. Albertson, D. B. Simons, and E. V. Richardson on 1197. John F. Neville closure to 1202. Mushtaq Ahmad on 1260. Corrections to 1262. Gale B. Dougherty on 1266. T. Blench on 1331. M. B. McPherson on 1332. F. V. A. Engel on 1345. H. C. Riggs on 1395.

1559. Discussion of Proceedings Paper 1143, 1161, 1301, 1309, 1427, 1428. (SM) Elbert E. Esmiol closure to 1143. T. H. Wu closure to 1161. Yoshichika Nishida on 1301. Irving Sherman on 1309. Edward S. Barber on 1427. Edward S. Barber on 1428.

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March

1560. Analysis of Braced Frames, by Kurt H. Gerstle. (ST) A method of analysis for knee-braced frames is presented. Values of fixed support forces, distribution factors, and carry-over factors are given. Procedure is explained by means of an example problem.

1561. Lateral Bracing of Columns and Beams, by George Winter. (ST) It is often necessary to determine the characteristics required of lateral bracing to counteract buckling of columns and beams. An elementary method is developed for calculating lower limits of strength and rigidity of lateral support in order to provide full bracing. This is defined as equivalent to immovable support.

1562. Numerical Solutions for Beams on Elastic Foundations, by Henry Malter. (ST) Two methods for the solution of beams on elastic foundations are considered. One is a step-by-step integration process and the other, using finite difference equations, obtains a solution by a set of simultaneous equations. Examples are solved and comparisons made between the results.

1563. Earthquake Response of Elevated Tanks and Vessels, by Donald F. Moran and James A. Cheney. (ST) Recent western United States earthquakes, while not as severe as can be expected to occur, have provided tests of many structures specifically designed to resist earthquake forces. A method of analysis is considered where minor damage to elevated water tank towers and refinery vessels can be explained.

1564. Analysis of Open-Spandrel Arches, by A. F. Diwan. (ST) This paper presents a mathematical solution for the open-spandrel arch. The solution is based on the principle of balancing the panel moments by imposing therein a special type of panel distortion which produces moments of a known pattern in the chords of the deformed panel only.

1565. The Design of the Main Towers of the Mackinac Bridge, by Kuang-Han Chu. (ST) Design aspects of the main towers of the Mackinac Straits Bridge are described in this paper. Design specifications are introduced, and principles of preliminary design are examined. Loading conditions, methods used, and results obtained in the final analysis are presented. Design aspects of details are also described.

1566. An Elastic Criterion for Plastic Design, by Herbert A. Sawyer, Jr. (ST) The significance of the elastic limit to deflection, local instability, and plastic fatigue in plastic design is investigated. An elastic limit criterion for plastic design is proposed.

1567. Moments in Restrained or Continuous Beams by the Method of Partial Moments, by Harry Posner. (ST) This paper presents a method of obtaining moments in beams by obtaining moments at each support with loading placed on one span at a time, and getting the moments at each support with all the spans loaded by combining these moments.

1568. Selection of Design Wave for Offshore Structures, by Charles L. Bretschneider. (WW) Methods are presented for the selection of the design wave, crest elevation, wave length, and maximum horizontal particle velocity at the crest for offshore structures. Wave data supplemented by wave theory are used for the development of generalized graphs for use with waves of finite height.

1569. Shipboard Hydraulic Breakwater, by R. A. Dilley. (WW) A model hydraulic breakwater was constructed on a 1:86.5 scale model Liberty Ship. Curves depicting the relationship between wave attenuation and jet flow, and the dependence of mooring forces on wave height are given.

1570. The Welland Canal, By W. A. O'Neil. (WW) The history of this Canadian canal is given from its inception in 1824. Planning criteria, detailed design information, and traffic data are presented. Original construction methods, maintenance problems, and solutions are examined. Plans are described for deepening the canal to St. Lawrence Seaway standards.

1571. Forces Induced on a Large Vessel by Surge, by John T. O'Brien and D. I. Kuchenreuther. (WW) Field measurements are presented of forces up to 40 kips induced by head-on standing waves of 1 and 2½ minute periods in lines of a 12,000-ton ship moored by unusually taut lines.

1572. Contractor's Planning for Navigation Locks, by F. J. Larkin. (WW) This paper deals with job planning for navigation locks and is concerned with selection of a construction plant. The construction of the Markland Locks Project on the Ohio River for the Corps of Engineers serves as an illustration.

1573. Breaking Wave Force Prediction, by R. L. Wiegel and R. E. Skjei. (WW) Laboratory data of the kinematics of waves breaking on a model beach are analyzed. Resulting water particle velocities and accelerations are used in the Morison-O'Brien-Johnson-Schaaf wave force theory to predict the force field for piles of three different diameters. Comparisons of results with predictions from a modified solitary wave theory are given.

1574. Pipeline Location Surveys, by Earl K. Monteith. (PL) The many problems faced by the locating engineer are varied, and the economics of any pipeline project are affected by decisions made in the field. This paper deals with the most common problems of the locating engineer.

1575. Digital Computers Applied to Pipeline Design, by Harold E. Thomas. (PL) This paper, in examining the application of digital computers to pipeline design problems, stresses the possibility of evaluating solutions under varying conditions in order to select the most desirable design.

1576. Discussion of Proceedings Paper 1187, 1188, 1190, 1303, 1353, 1355, 1356, 1357, 1431, 1432, 1434, 1510. (ST) Benjamin C. F. Wei closure to 1187. E. Czerniak closure to 1188. Haaren A. Miklofsky and Omar J. Sotillo closure to 1190. Louis Balog on 1303. Thomas C. Coleman, Thomas D. Y. Fok on 1353. Herbert S. Saffir on 1355. Kuang-Han Chu, Myle J. Holley and Vitelmo Bertero, I. Earl Lewis, Jr. on 1356. Bruce G. Johnston, Paul J. Brennan on 1357. Kuang-Han Chu on 1431. Paul Spindel on 1432. James M. Gere, Joseph J. Hromadik, D. A. Mackenzie, A. A. Eremin on 1434. G. C. Ernst on 1510.

1577. Water Distribution Problems Solved by Network Calculators, by L. M. Haupt. (PL) The alternating current network calculator is an analogue computer that can be adapted to the solution of pipeline distribution problems. This paper describes the use of this computer on this type of problem.

1578. Discussion of Proceedings Paper 1195. (PL) Robert D. Kersten and Edwin J. Waller closure to 1195.

1579. Discussion of Proceedings Paper 1366. (WW) Samuel Heyman, Cevdet Z. Erzen on 1366.

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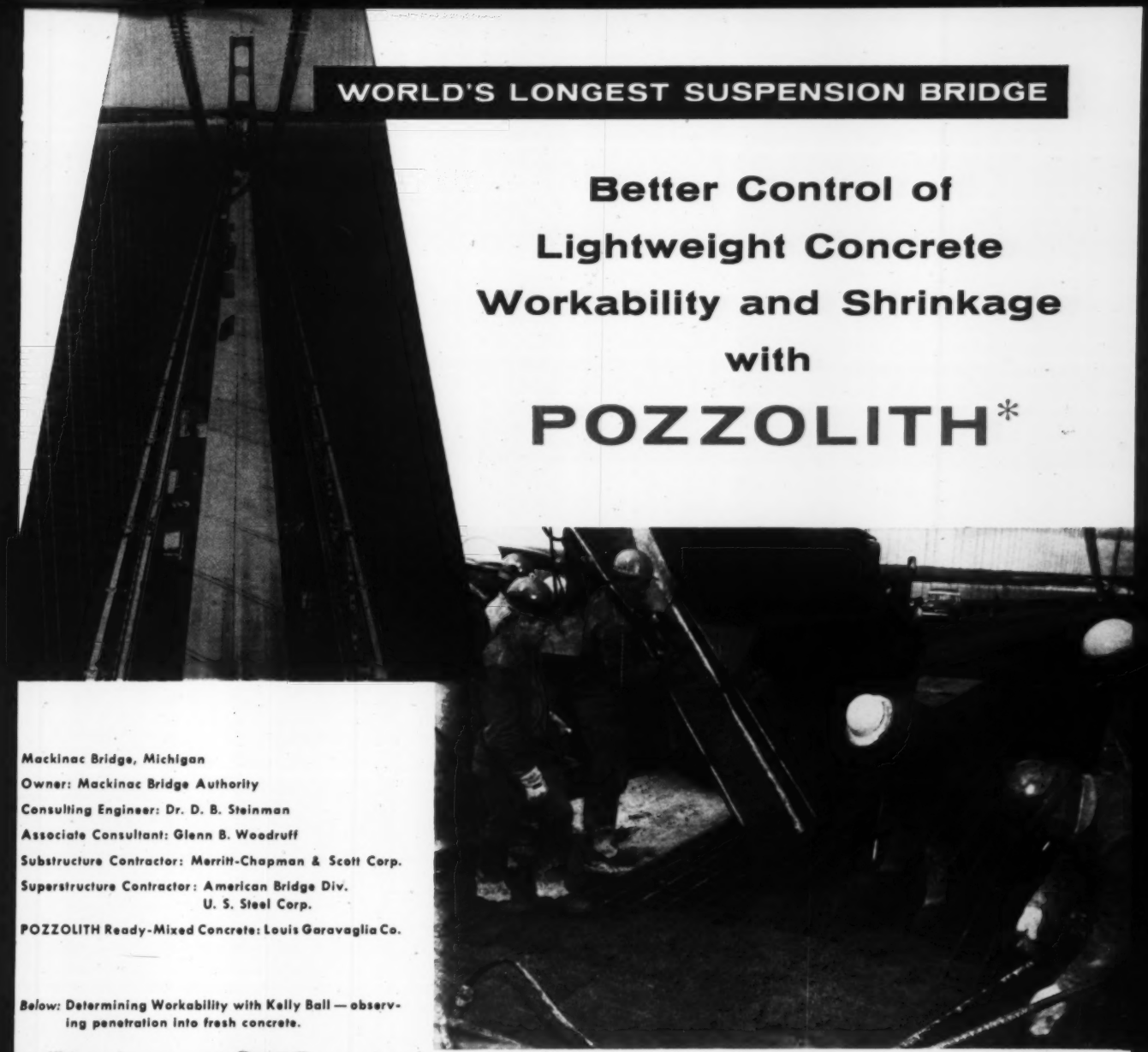

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